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The purpose of this project is to enhance the value of the California Cancer Registry as a research tool for clinicians and epidemiologists interested in conducting breast cancer research. The objectives of the project are to: (1) classify breast cancers according to all staging schemes currently in use in the United States; (2) increase the amount of treatment data for early stage breast cancer; and (3) link breast cancer case data with other data bases to enhance survival data and collect co-morbidity information. Due to difficulties in finding qualified registrars to perform EOD coding on the backlog of cases, the project is slightly behind schedule for EOD coding and for reclassifying cases to AJCC stage. However, we expect to complete this phase of the project during Year 03. Follow-back to physicians for first course of treatment data has been delayed due to unforseen computer software deficiencies. The software specifications and development have been completed and the software is currently undergoing beta testing. Physician follow-back will become functional during Year 03. Finally, linkage activities are on schedule. These activities have resulted in one presentation to a professional society and one paper accepted for publication in a scientific journal.

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FOREWORD

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William E. Wright 12/31/86

PI - Signature Date

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INTRODUCTION

The purpose of this project is to enhance the value of the California Cancer Registry (CCR) as a research tool for clinicians and epidemiologists interested in conducting breast cancer research. The California Cancer Registry began statewide population-based coverage on January 1, 1988. Between 1988 and 1993 all breast cancers were staged according to the National Cancer Institute's (NCI) Surveillance, Epidemiology, and End Results (SEER) Program Summary Staging Guide (1), basically a classification of cases into in situ, localized, regional and distant disease. A major objective of this award has been to reclassify all breast cancer cases diagnosed between 1988-93 according to the SEER Program's Extent of Disease (2) classification scheme and to apply a computer program available from the NCI to classify cases into the TNM classifications and the Staging Categories (0, I, II, III, IV) of the American Joint Committee on Cancer (3). This would allow for classification of breast cancer according to all staging schemes currently in use in the United States so that researchers could classify breast cancer cases according to the scheme most useful to their research.

A second objective of this award was to enhance the availability of breast cancer treatment data included in the CCR. Detailed and complete treatment data for all breast cancer cases is difficult to ascertain due to the fact that much treatment, especially chemotherapy, is given outside of acute care facilities. The approach has been to compare for individual patients the treatment information currently recorded into the data base to that recommended in the NCI's Patient Data Query (PDQ) data base. For all patients not recorded as having received the recommended treatment, the physician of record is to be queried regarding any additional treatment which the breast cancer patient may have received as a part of her initial course of therapy.

A third objective of the award has been to link the CCR breast cancer cases against other available data bases to enhance survival data by updating current vital status of breast cancer patients and to identify groups of women who may be at an increased risk to breast cancer.

BODY

Progress to date:

Objective 1 - Reclassifying Breast Cancer Cases According to the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) Program Extent of Disease (EOD) and the American Joint Committee on Cancer (AJCC) Staging schemes.

Stage or extent of disease at the time of initial diagnosis is currently felt to be the most important prognostic factor available to plan an appropriate course of treatment for breast cancer patients. Further, stage of disease is important in accessing programs to detect breast cancer at earlier stages when the disease is more curable. There are multiple schemes available to categorize patients according to their stage at diagnosis. Each of these schemes is suited to measuring a particular aspect of disease. For example, the scheme of classifying patients according to categories of in situ,

localized, regional, and distant disease was introduced by the National Cancer Institute in the early 1950s and has been in continuous use since that time. This scheme, therefore, is useful in examining time trends and in determining the impact of screening programs.

This historical classification, however, is not particularly useful in treatment planning, since the more detailed staging categories of the American Joint Committee on Cancer (AJCC) based on size of tumor and lymph node involvement are preferred by physicians. Fortunately, the SEER Program has developed a classification scheme, referred to as extent of disease (EOD) at diagnosis, which allows for the collection of detailed data on size of tumor, extension of tumor, and lymph node involvement which will allow the collapse of data into either scheme. The major objective of this procurement has been to reclassify the CCR's backlog of cases according to SEER EOD and then into AJCC staging categories.

For purposes of cancer reporting, the State of California and its 31.7 million population has been divided into 10 distinct geographic regions ranging in population from 1.4 million in the Northern Sierra Region (a 16-county area) to a population of 9.2 million in the single-county reporting area of Los Angeles. Table 1 shows the number of female breast cancer cases by region and year of diagnosis (1988-1994) which have been received by the CCR as of October 1996. As of that time, the CCR has received reports on 138,810 female breast cancers diagnoses among California residents. However, we have currently completed EOD coding on 84.4% of all breast cancer cases contained in the CCR files. Extent of Disease is categorized by three fields: Extension of the tumor (DIREXTTU), tumor size (TSIZETU), and lymph node involvement (LNSUMTU). A code of "unknown" means that the file did not contain sufficient information to code this field while a code of "blank" means that the file was not searched for this variable. Tables 2-4 present the number of cases which are currently coded as "unknown" or "blank" for each EOD field by region and year of diagnosis, and Figures 1-10 present the percent of cases which are coded as "unknown" or "blank" for each EOD field by reporting region and year of diagnosis. There is some variation in the completeness of coding by region. Regions 1, 8, and 9 have completed EOD coding for current and historical breast cancer cases from 1988-1994. Regions 2, 5, 7, and 10 still have a relatively small percentage of blanks in fields prior to 1994, and Regions 3, 4, and 6 have significant backlog in coding EOD for historical cases.

Both the money awarded and the availability of experienced coders have not been sufficient to complete coding of the entire historical data bases during Years 01 and 02 of this award. However, additional funding has become available through a special tax imposed on cigarettes that is devoted to breast cancer research. These resources are being applied to the effort to code the entire historical file. We estimate that this will be accomplished by May, 1997. Once the coding has been completed, we will then apply the NCI software program to convert EOD coding into the AJCC Staging Categories.

TABLE 1

Female breast cancer cases (in situ and invasive), resident w/in reporting region, CCR (OCT96), 1988-1994 2
13:39 Monday, December 30, 1996

TABLE OF REGIONID BY YEARDX

REGIONID(Reporting Region) YEARDX(Year of diagnosis (YY))

Frequency	88	89	90	91	92	93	94	Total
1	1272	1321	1284	1401	1419	1431	1403	9531
2	1170	1113	1314	1363	1362	1390	1479	9191
3	1737	1689	1812	1886	1968	1843	1898	12833
4	830	785	850	894	908	923	946	6136
5	1471	1428	1647	1673	1667	1780	1667	11333
6	972	960	1011	1086	1146	1077	1206	7458
7	1537	1576	1748	1861	1951	1865	1843	12381
8	2878	2847	2976	3009	3084	2973	3126	20893
9	5473	5157	5273	5235	5495	5320	5336	37289
10	1608	1526	1658	1646	1813	1782	1732	11765
Total	18948	18402	19573	20054	20813	20384	20636	138810

TABLE 2

EOD coding on resident female breast cancer (in situ and invasive) cases on Oct96 submission 1
Number and percent of cases where DIREXTTU is coded as unknown (9s) or blank

Cases		Year of Dx						
		88	89	90	91	92	93	94
Region	Coding							
1	Unknown	62	66	69	49	47	68	32
2	Blank	34	33	44	37	34	8	0
	Unknown	67	38	24	22	34	69	61
3	Blank	1,717	1,519	1,397	332	2	14	0
	Unknown	12	8	25	22	46	49	61
4	Blank	424	562	507	62	41	20	0
	Unknown	194	36	32	26	35	24	34
5	Blank	50	65	130	108	66	42	0
	Unknown	30	30	36	36	55	56	51
6	Blank	697	689	838	975	980	772	0
	Unknown	77	85	24	15	13	22	76
7	Blank	1,499	366	303	295	302	61	6
	Unknown	6	59	92	86	98	87	78
8	Unknown	78	79	88	76	93	96	50
9	Blank	45	30	28	39	0	0	0
	Unknown	248	230	213	179	161	166	154
10	Blank	591	324	239	219	285	34	6
	Unknown	39	84	99	80	84	78	53

TABLE 3

EOD coding on resident female breast cancer (in situ and invasive) cases on Oct96 submission 3
Number and percent of cases where TSIZETTU is coded as unknown (9s) or blank

Cases		Year of Dx						
		88	89	90	91	92	93	94
Region	Coding							
1	Unknown	281	250	252	265	272	280	224
2	Blank	24	41	42	15	21	6	0
	Unknown	217	210	244	238	237	199	242
3	Blank	139	92	247	67	0	4	0
	Unknown	393	365	522	335	384	218	254
4	Blank	149	174	145	25	12	11	0
	Unknown	122	128	126	148	163	149	149
5	Blank	11	11	13	3	0	0	0
	Unknown	280	227	273	287	308	313	229
6	Blank	336	390	451	327	267	161	0
	Unknown	145	120	93	123	112	138	237
7	Blank	385	312	292	290	295	25	4
	Unknown	146	204	301	265	258	248	269
8	Unknown	501	420	470	415	420	374	364
9	Blank	13	10	9	8	0	0	0
	Unknown	799	704	626	672	649	664	602
10	Blank	327	277	236	218	280	17	6
	Unknown	199	243	277	248	205	217	234

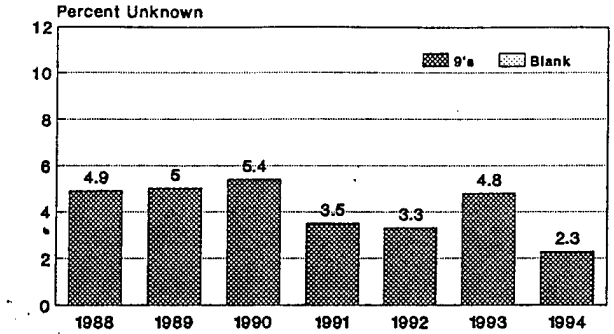
TABLE 4

EOD coding on resident female breast cancer (in situ and invasive) cases on Oct96 submission 5
Number and percent of cases where LNSUMTU is coded as unknown (9s) or blank

Cases		Year of Dx						
		88	89	90	91	92	93	94
Region	Coding							
1	Unknown	107	145	121	116	113	178	137
2	Blank	34	34	45	37	34	10	0
	Unknown	125	113	132	122	153	182	132
3	Blank	1,646	1,464	1,361	326	3	14	0
	Unknown	25	19	73	67	276	162	139
4	Blank	466	568	496	62	40	23	0
	Unknown	119	34	45	84	98	93	84
5	Blank	50	64	128	109	66	43	0
	Unknown	109	103	116	112	128	164	184
6	Blank	683	658	833	974	980	770	0
	Unknown	71	73	28	15	28	48	156
7	Blank	1,340	361	302	295	302	61	6
	Unknown	8	89	113	140	125	156	144
8	Unknown	275	251	224	203	230	268	262
9	Blank	46	29	31	40	0	0	0
	Unknown	531	402	392	392	464	423	410
10	Blank	577	324	239	219	285	34	6
	Unknown	56	137	150	114	119	135	107

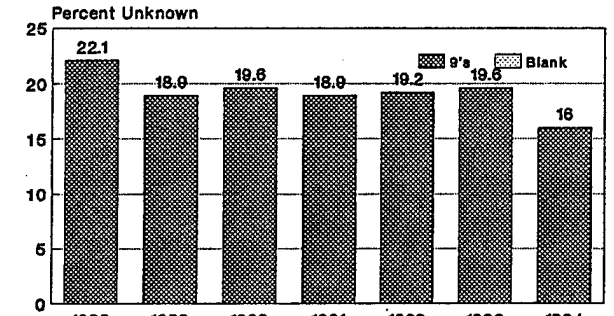
FIGURE 1

Breast Cancer EOD Coding Status, Oct96
Percent DIREXTU Coded 9's or Blank
REGION 1



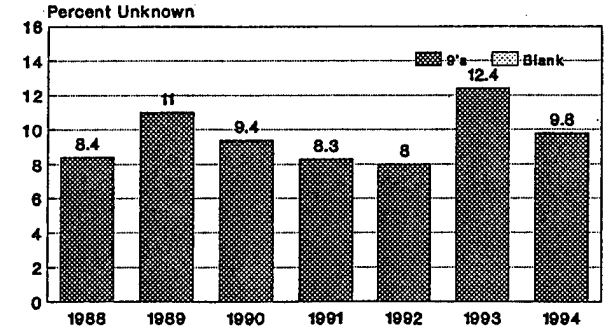
	1988	1989	1990	1991	1992	1993	1994
Blank	0	0	0	0	0	0	0
9's	4.9	5	5.4	3.5	3.3	4.8	2.3

Breast Cancer EOD Coding Status, Oct96
Percent TSIZETU Coded 9's or Blank
REGION 1



	1988	1989	1990	1991	1992	1993	1994
Blank	0	0	0	0	0	0	0
9's	22.1	18.9	19.6	18.9	19.2	19.6	16

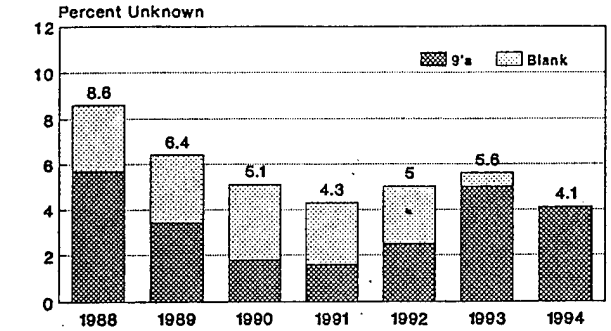
Breast Cancer EOD Coding Status, Oct96
Percent LNSUMTU Coded 9's or Blank
REGION 1



	1988	1989	1990	1991	1992	1993	1994
Blank	0	0	0	0	0	0	0
9's	8.4	11	9.4	8.3	8	12.4	9.8

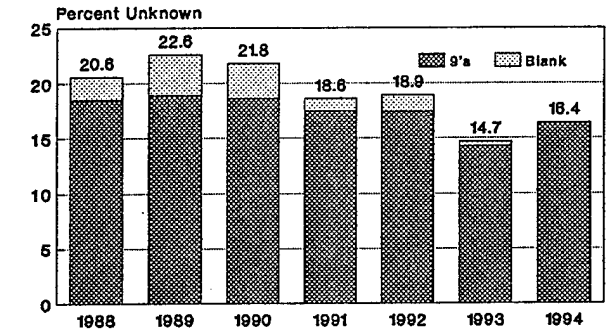
FIGURE 2

Breast Cancer EOD Coding Status, Oct96
Percent DIREXTU Coded 9's or Blank
REGION 2



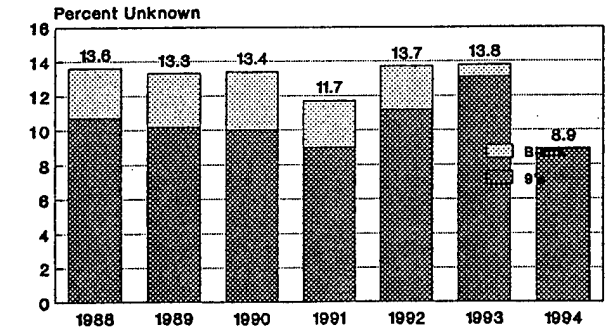
	1988	1989	1990	1991	1992	1993	1994
Blank	2.9	3	3.3	2.7	2.5	0.6	0
9's	5.7	3.4	1.8	1.6	2.5	5	4.1

Breast Cancer EOD Coding Status, Oct96
Percent TSIZETU Coded 9's or Blank
REGION 2



	1988	1989	1990	1991	1992	1993	1994
Blank	2.1	3.7	3.2	1.1	1.5	0.4	0
9's	18.5	18.9	18.6	17.5	17.4	14.3	16.4

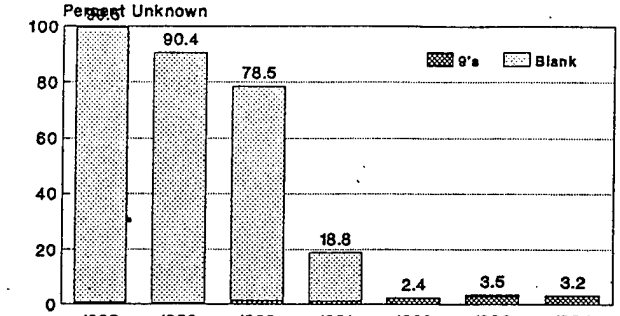
Breast Cancer EOD Coding Status, Oct96
Percent LNSUMTU Coded 9's or Blank
REGION 2



	1988	1989	1990	1991	1992	1993	1994
Blank	2.9	3.1	3.4	2.7	2.5	0.7	0
9's	10.7	10.2	10	9	11.2	13.1	8.9

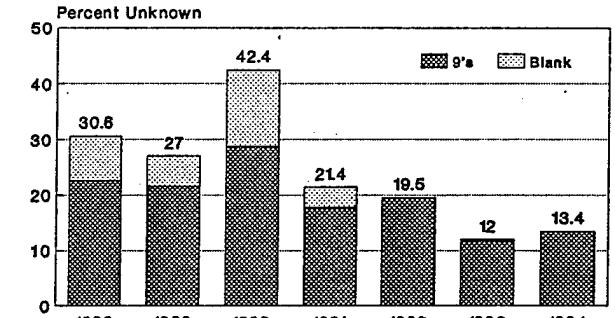
FIGURE 3

Breast Cancer EOD Coding Status, Oct96
Percent DIREXTU Coded 9's or Blank
REGION 3



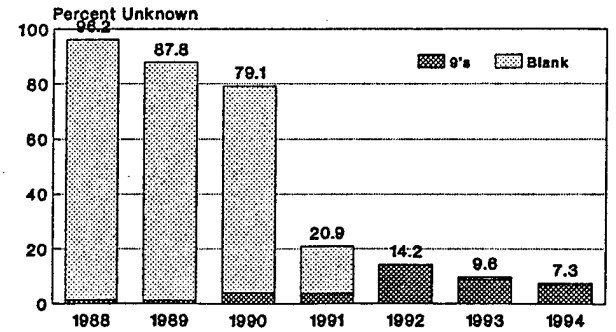
	1988	1989	1990	1991	1992	1993	1994
Blank	98.8	89.9	77.1	17.6	0.1	0.8	0
9's	0.7	0.5	1.4	1.2	2.3	2.7	3.2

Breast Cancer EOD Coding Status, Oct96
Percent TSIZETU Coded 9's or Blank
REGION 3



	1988	1989	1990	1991	1992	1993	1994
Blank	8	5.4	13.6	3.6	0	0.2	0
9's	22.6	21.6	28.8	17.8	19.5	11.8	13.4

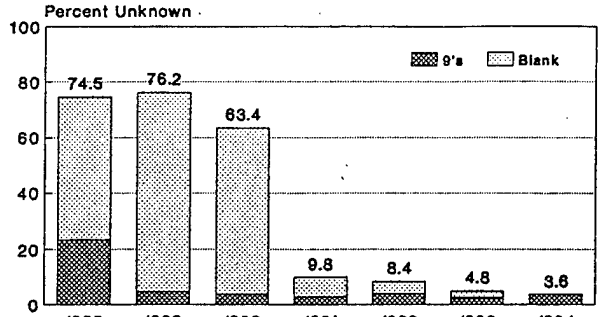
Breast Cancer EOD Coding Status, Oct96
Percent LNSUMTU Coded 9's or Blank
REGION 3



	1988	1989	1990	1991	1992	1993	1994
Blank	94.8	86.7	75.1	17.3	0.2	0.8	0
9's	1.4	1.1	4	3.6	14	8.8	7.3

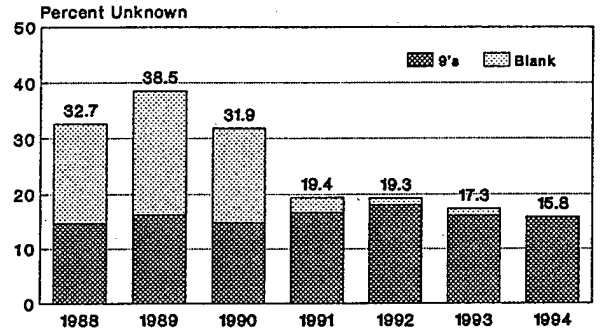
FIGURE 4

Breast Cancer EOD Coding Status, Oct96
Percent DIREXTU Coded 9's or Blank
REGION 4



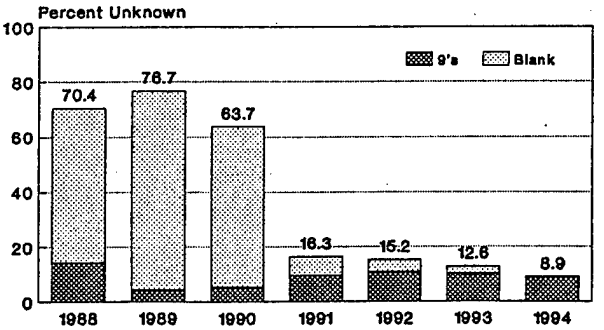
	1988	1989	1990	1991	1992	1993	1994
Blank	51.1	71.6	59.6	6.9	4.5	2.2	0
9's	23.4	4.6	3.8	2.9	3.9	2.6	3.6

Breast Cancer EOD Coding Status, Oct96
Percent TSIZETU Coded 9's or Blank
REGION 4



	1988	1989	1990	1991	1992	1993	1994
Blank	18	22.2	17.1	2.8	1.3	1.2	0
9's	14.7	16.3	14.8	16.6	18	16.1	15.8

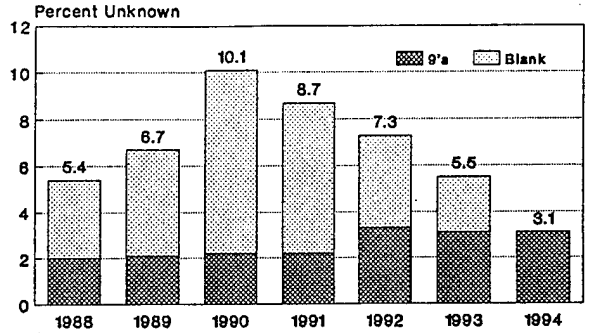
Breast Cancer EOD Coding Status, Oct96
Percent LNSUMTU Coded 9's or Blank
REGION 4



	1988	1989	1990	1991	1992	1993	1994
Blank	56.1	72.4	58.4	6.9	4.4	2.5	0
9's	14.3	4.3	5.3	9.4	10.8	10.1	8.9

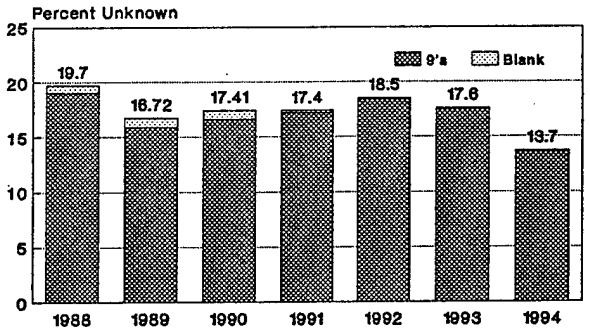
FIGURE 5

Breast Cancer EOD Coding Status, Oct96
Percent DIREXTU Coded 9's or Blank
REGION 5



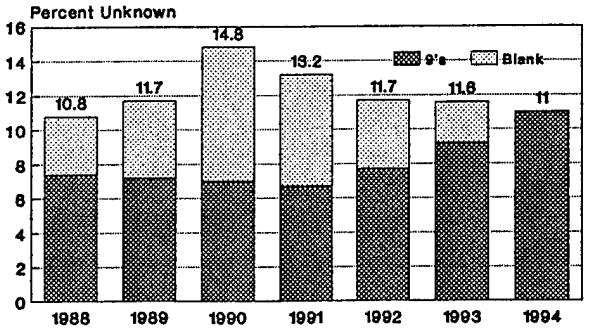
	1988	1989	1990	1991	1992	1993	1994
Blank	3.4	4.6	7.9	6.5	4	2.4	0
9's	2	2.1	2.2	2.2	3.3	3.1	3.1

Breast Cancer EOD Coding Status, Oct96
Percent TSIZETU Coded 9's or Blank
REGION 5



	1988	1989	1990	1991	1992	1993	1994
Blank	0.7	0.82	0.81	0.2	0	0	0
9's	19	15.9	16.6	17.2	18.5	17.6	13.7

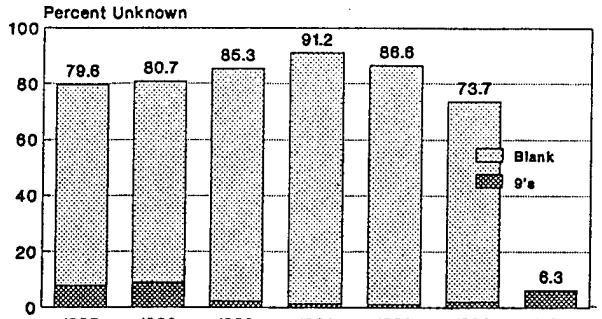
Breast Cancer EOD Coding Status, Oct96
Percent LNSUMTU Coded 9's or Blank
REGION 5



	1988	1989	1990	1991	1992	1993	1994
Blank	3.4	4.6	7.8	6.5	4	2.4	0
9's	7.4	7.2	7	6.7	7.7	9.2	11

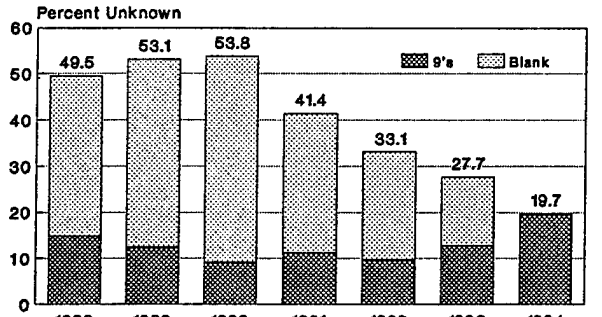
FIGURE 6

Breast Cancer EOD Coding Status, Oct96
Percent DIREXTU Coded 9's or Blank
REGION 6



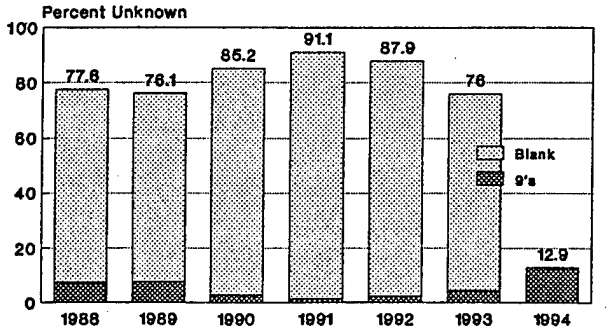
	1988	1989	1990	1991	1992	1993	1994
Blank	71.7	71.8	82.9	89.8	85.5	71.7	0
9's	7.9	8.9	2.4	1.4	1.1	2	6.3

Breast Cancer EOD Coding Status, Oct96
Percent TSIZETU Coded 9's or Blank
REGION 6



	1988	1989	1990	1991	1992	1993	1994
Blank	34.6	40.6	44.6	30.1	23.3	14.9	0
9's	14.9	12.5	9.2	11.3	9.8	12.8	19.7

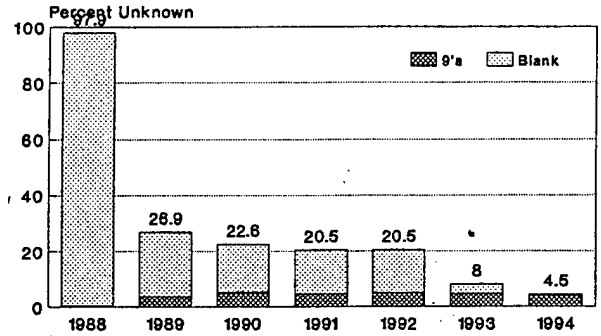
Breast Cancer EOD Coding Status, Oct96
Percent LNSUMTU Coded 9's or Blank
REGION 6



	1988	1989	1990	1991	1992	1993	1994
Blank	70.3	68.5	82.4	89.7	85.5	71.5	0
9's	7.3	7.6	2.8	1.4	2.4	4.5	12.9

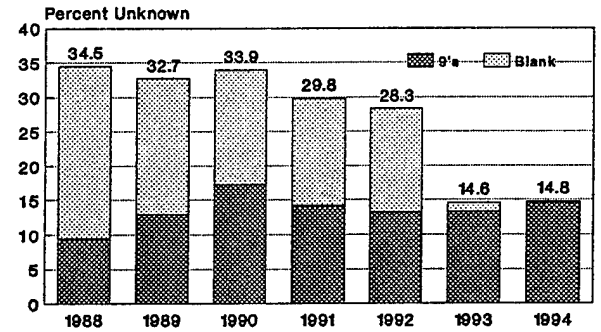
FIGURE 7

Breast Cancer EOD Coding Status, Oct96
Percent DIREXTU Coded 9's or Blank
REGION 7



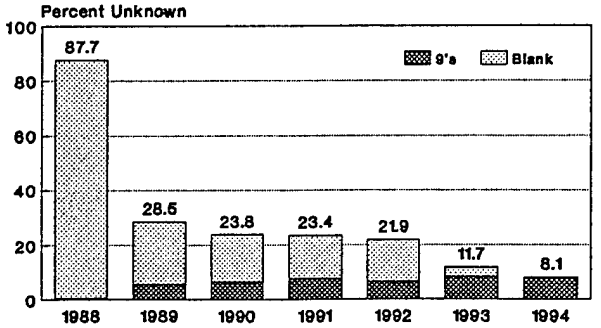
	1988	1989	1990	1991	1992	1993	1994
Blank	97.5	23.2	17.3	15.9	15.5	3.3	0.3
9's	0.4	3.7	5.3	4.6	5	4.7	4.2

Breast Cancer EOD Coding Status, Oct96
Percent TSIZETU Coded 9's or Blank
REGION 7



	1988	1989	1990	1991	1992	1993	1994
Blank	25	19.8	16.7	15.6	15.1	1.3	0.2
9's	9.5	12.9	17.2	14.2	13.2	13.3	14.6

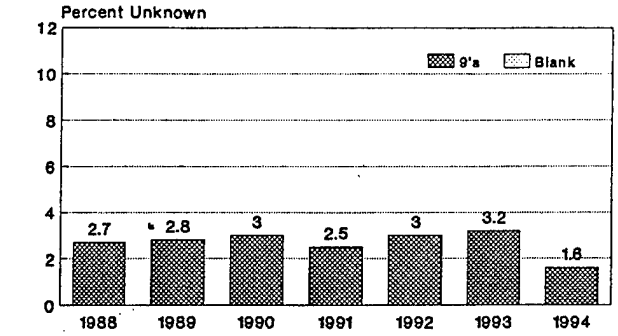
Breast Cancer EOD Coding Status, Oct96
Percent LNSUMTU Coded 9's or Blank
REGION 7



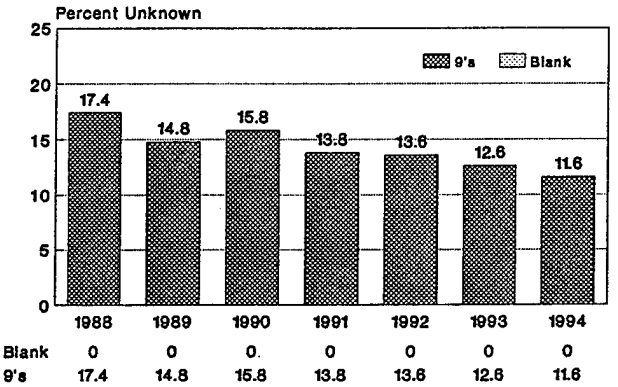
	1988	1989	1990	1991	1992	1993	1994
Blank	87.2	22.9	17.3	15.9	15.5	3.3	0.3
9's	0.5	5.6	6.5	7.5	6.4	8.4	7.8

FIGURE 8

Breast Cancer EOD Coding Status, Oct96
Percent DIREXTU Coded 9's or Blank
REGION 8



Breast Cancer EOD Coding Status, Oct96
Percent TSIZETU Coded 9's or Blank
REGION 8



Breast Cancer EOD Coding Status, Oct96
Percent LNSUMTU Coded 9's or Blank
REGION 8

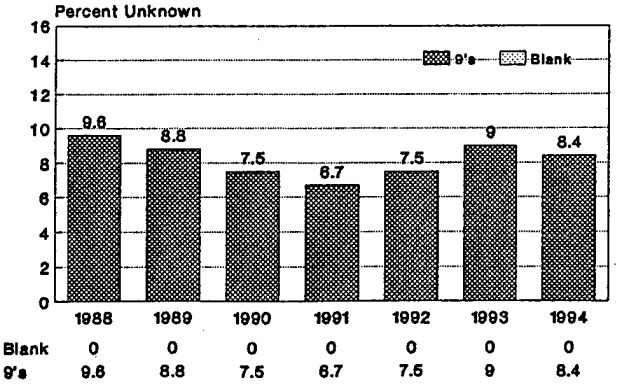
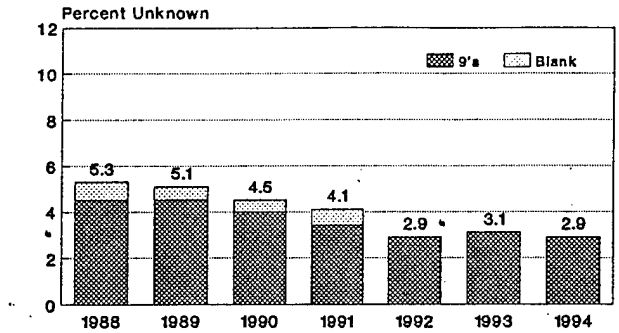


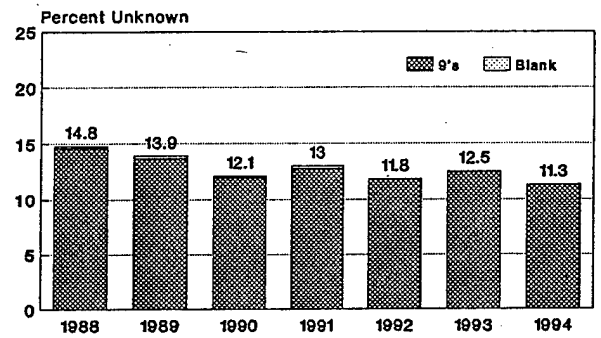
FIGURE 9

Breast Cancer EOD Coding Status, Oct96
Percent DIREXTU Coded 9's or Blank
REGION 9



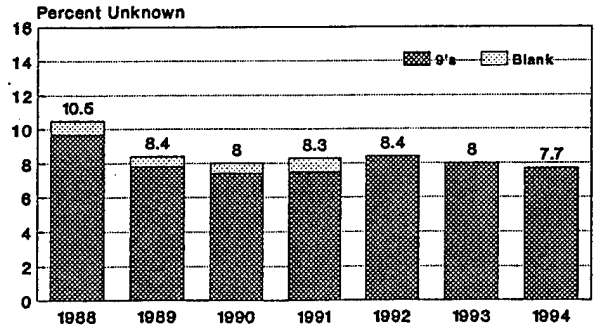
	1988	1989	1990	1991	1992	1993	1994
Blank	0.8	0.6	0.5	0.7	0	0	0
9's	4.5	4.5	4	3.4	2.9	3.1	2.9

Breast Cancer EOD Coding Status, Oct96
Percent TSIZETU Coded 9's or Blank
REGION 9



	1988	1989	1990	1991	1992	1993	1994
Blank	0.2	0.2	0.2	0.2	0	0	0
9's	14.6	13.7	11.9	12.8	11.8	12.5	11.3

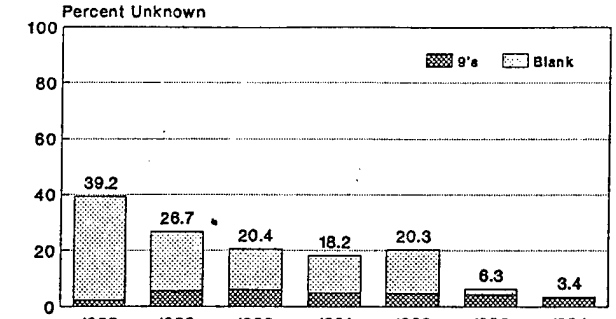
Breast Cancer EOD Coding Status, Oct96
Percent LNSUMTU Coded 9's or Blank
REGION 9



	1988	1989	1990	1991	1992	1993	1994
Blank	0.8	0.6	0.6	0.8	0	0	0
9's	9.7	7.8	7.4	7.5	8.4	8	7.7

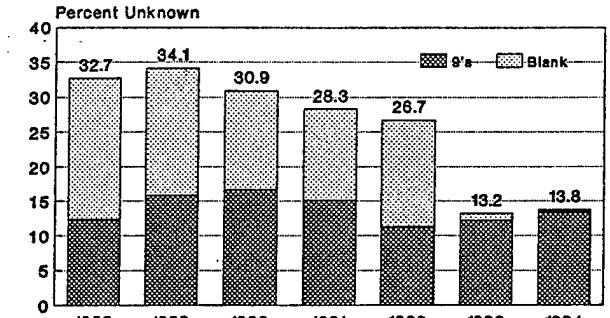
FIGURE 10

Breast Cancer EOD Coding Status, Oct96
Percent DIREXTU Coded 9's or Blank
REGION 10



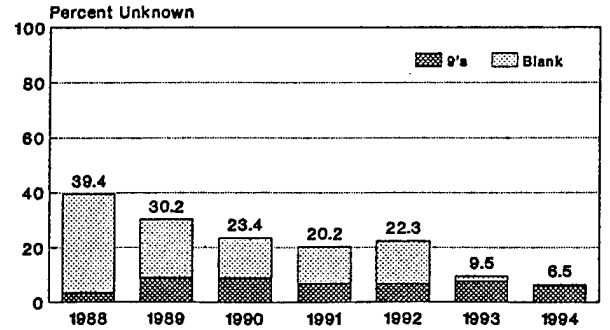
	1988	1989	1990	1991	1992	1993	1994
Blank	36.8	21.2	14.4	13.3	15.7	1.9	0.3
9's	2.4	5.5	6	4.9	4.6	4.4	3.1

Breast Cancer EOD Coding Status, Oct96
Percent TSIZETU Coded 9's or Blank
REGION 10



	1988	1989	1990	1991	1992	1993	1994
Blank	20.3	18.2	14.2	13.2	15.4	1	0.3
9's	12.4	15.9	16.7	15.1	11.3	12.2	13.5

Breast Cancer EOD Coding Status, Oct96
Percent LNSUMTU Coded 9's or Blank
REGION 10



	1988	1989	1990	1991	1992	1993	1994
Blank	35.9	21.2	14.4	13.3	15.7	1.9	0.3
9's	3.5	9	9	6.9	6.6	7.8	6.2

Objective 2: Enhancing the Availability of Cancer Treatment Data in the California Cancer Registry

Until recently, most population-based registries outside the SEER Program network have been incidence only registries and have not been concerned with the collection of treatment data. Since its inception, the California Cancer Registry has recorded the first course of cancer treatment for all patients. Unfortunately, the data are know to be incomplete, especially for those cancer sites such as breast cancer which are occasionally treated with a first course of chemotherapy and eventually followed up with radiation therapy. Chemotherapy and radiation therapy are primarily given outside the acute care hospital setting, and hospital medical records often lack the details of the complete first course of therapy being given.

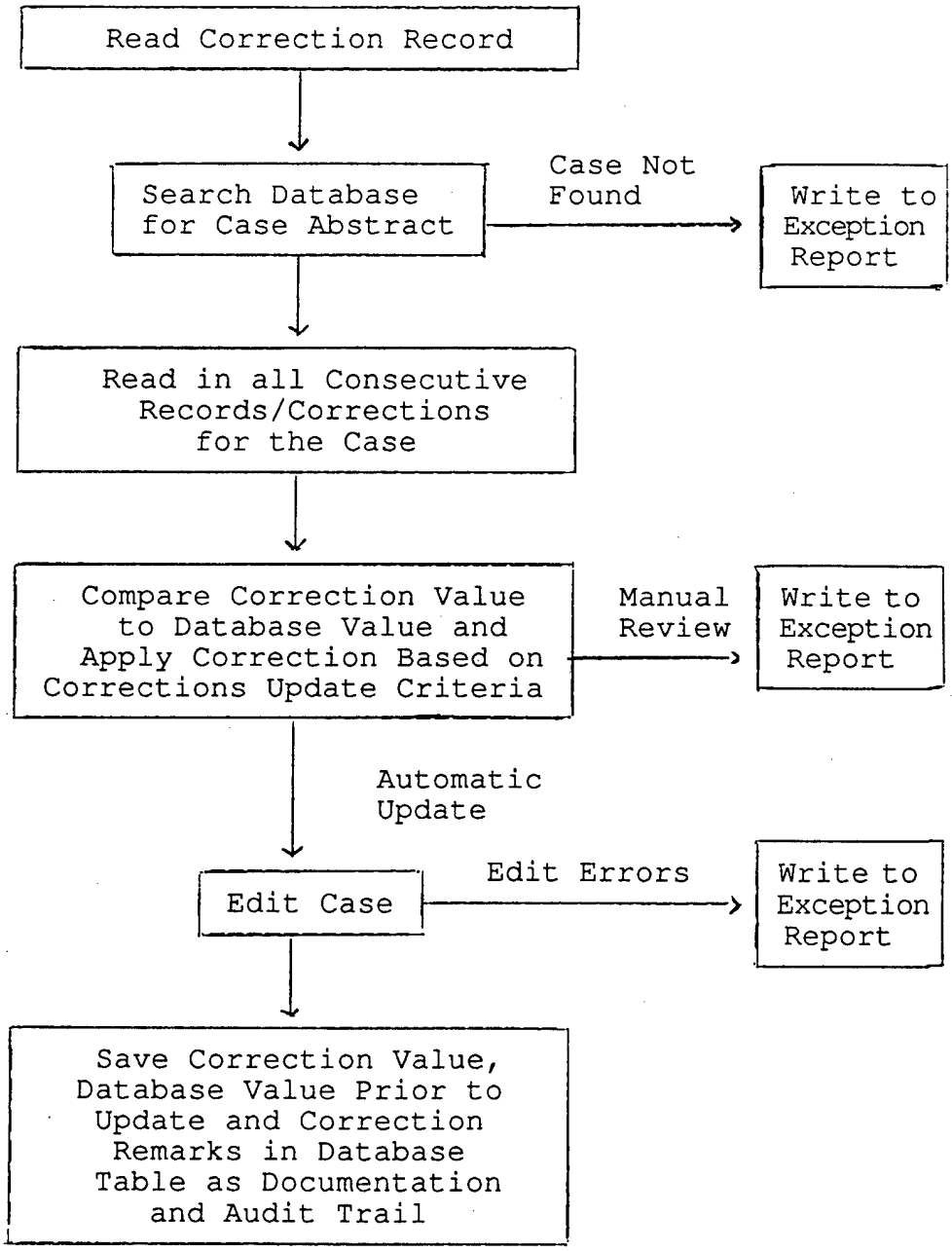
Data on female breast cancers come in to the CCR from multiple sources. Frequently there are admissions to more than one hospital, and additional treatment information may come in from a physicians office or from an updated hospital record. When a new patient record is received from a hospital by a regional registry, it is either entered as a new case or "consolidated" with the records from other facilities into a single record. Hospitals frequently abstract and report a case shortly after it is diagnosed and treated in that facility. Subsequently, the hospital registrar may learn of additional treatment and update the hospital record. The updated information is then transmitted to the regional registry as a "correction" record.

Due to limited resources, the CCR had not developed software to process these correction records electronically. In addition, due to budget cutbacks, quality control staff have not been available to review these records before applying them to the main data base. Historically, only the San Francisco Bay Area SEER registry had processed these records on a routine basis using resources available from the NCI, and they had to process them manually. The other regional registries in California had stockpiled their correction records since the implementation of statewide reporting (1988). Consequently there was an unknown amount of treatment information contained in the stockpiled correction records. This information needed to be processed and added to the main data base before any given breast cancer record could be compared with the standard recommended treatment, and before any routine follow-back to physicians concerning possible incomplete treatment could be initiated.

Early in 1996 a Correction Records Processing Task Force was formed with representatives from the central and regional registries. Figure 11 illustrates the data flow for correction record processing. The Task Force developed specifications for comparing correction record data with the main data base, decision rules for how to handle discrepancies, and decision rules for automating as much of the process as possible. Appendix I contains a copy of the current processing specifications. We have written computer software to implement the specifications in the four different software systems used by the regional registries. The software is currently undergoing beta testing at four sites, and we expect it to be fully functional by February 1, 1997. (All of the specification and software development was funded from the breast cancer tobacco tax funds that have been made available to the CCR.)

FIGURE 11

CORRECTION RECORD PROCESSING
DATA FLOW



Once the backlog of correction records is processed, we will initiate physician follow-back to collect additional treatment data. We expect to begin that function in May, 1997 targeting on 1994 breast cancer diagnoses.

Objective 3: Linkage of the California Cancer Registry with Other Data Bases to Enhance Survival Data, Collect Comorbidity Information, and Identify Women at High Risk to Breast Cancer

During the past year, additional progress has been made on the linkage project with the Health Care Financing Administration (HCFA) MediCare files. The initial linkage, which was reported in the Year 01 Progress Report, was performed on a cohort of 6,241 women who requested payment for breast cancer treatment in 1993 at either a hospital or ambulatory surgery center. This cohort was linked with the October, 1995 submission of 188,021 breast cancers diagnosed throughout the state from 1998-1993 and the historical data for Region 8 dating back to 1973. This linkage yielded a 95.9% match. During Year 02, we sent the list of 259 HCFA records that were listed as being treated in California facilities but did not match with the CCR data base to our regional registries and requested follow-back on those individuals. The results of this follow-back are as follows:

- 32 (12.4%) could not be resolved. 31 of these cases used treatment facilities outside of California and, therefore, could not be resolved. The treatment center on the Medicare file did not have a record of the one remaining patient.

- 128 (49.4%) were not reportable to the CCR as breast cancer. 61 had an out of state or unknown residence at diagnosis. 39 had a date of diagnosis prior to the reference date of the region. 20 were not cancers. 8 had cancer other than breast cancer.

- 21 (8.1%) were known, but added to the CCR data base late. 12 were added after October 1, 1995. 6 were on the suspense file at the region. 3 were shared with other regions, but had not yet appeared on the data base.

- 15 (5.8%) were known, but were non-matches during the linkage. 8 were considered during the linkage, but there were too many differences between the records to conclude they were a match. 7 were incorrectly coded as male on the CCR.

- There were 63 (24.3%) new cases identified. 41 (65.1% of these 63) were from ambulatory surgery centers with the remaining 22 from hospitals. 41 were missed by the abstractor, 15 were not reported by a pathology laboratory and 3 were not reported by a doctor. 52 were diagnosed in 1993, 5 in 1992 and 6 had an unknown year of diagnosis. 15 were *in situ*, 39 were invasive and 7 had an unknown stage of diagnosis.

The results of this linkage study were presented at the annual meeting of the North American Association of Central Cancer Registries annual meeting in Minneapolis, Minn. on April 17, 1996 (see Abstract in Appendix II). A research paper based in part on this linkage and authored by colleagues at California Medical Review, Inc. (CMRI) has been accepted for publication (see Appendix III).

The next step of this process was to request Part B data (in order to gather co-morbidities) from the HCFA. We requested these data from California Medical Review, Inc. which is the HCFA contractor in Northern California on June 3, 1996 (See Appendix IV). We have been informed that the HCFA cannot currently respond to the CMRI request but should be able to do so in 1997.

A similar set of linkage activities were performed in Year 02 with hospital discharge data obtained from the Office of Statewide Health Planning and Development (OSHPD). Since the OSHPD files do not contain names, the purpose for this linkage was to examine its value for providing follow-up information and comorbidities for the breast cancer cases contained in the CCR. We obtained access to hospital discharge data for 1992-1994. Discharges during each year were selected for women aged 20 or over with a non-pregnancy related diagnosis. This selection criteria yielded approximately 1.1 million records per year. Each hospital record had social security number, date of birth, date of admission and discharge, but no names. The hospital discharge records were linked against the October, 1995 CCR data file of 114,010 female breast cancer cases with a social security number, resident in California, and diagnosed between 1988-1993. Table 5 presents the results of the follow-up linkage. In summary, it seems that if we linked the CCR files to the OSHPD files on an annual basis, we could update the last date of contact on approximately 7% of the CCR records. This additional follow-up information could be very important for assessing breast cancer survival.

A third set of linkages was performed with the Department of Motor Vehicles (DMV) records during Year 02. In June we sent approximately 111,000 cases (all cancers with approximately 10% of these being breast cancer cases) to the DMV. About 44,000 (40%) of the cases were linked with the DMV files. Of these, about 22,000 had a DMV date of contact that was more recent than the CCR follow-up date (last date of contact). Assuming that all of these cases were alive on their date of contact with the DMV, then about 20% of the cases were updated. During the next year we will explore administrative arrangements to have DMV follow-up linkage become a routine function of CCR case processing.

TABLE 5

Follow-up of Alive Women with Breast Cancer, with Social Security Number, Resident in Region

Current Follow up year on CCR	Number on CCR	On OSHPD 92	On OSHPD 93	On OSHPD 93, but not 92	On OSHPD 94	On OSHPD 94, but not 92 nor 93
88	2,850	257	256	185	288	180
89	4,850	463	476	362	496	284
90	5,752	574	538	413	606	385
91	6,944	799	724	523	739	455
92	7,101	487	772	654	775	552

For follow up it appears that for any one year of the OSHPD data, we could update about 10% of the records to that year (257-288 for follow up year 88) although it looks like only about 60-70% of these (180-185 for 88) are different than the previous year. So on an annual basis we should be able to update 6-7% of the follow up dates to that year.

CONCLUSIONS

Due to difficulties in finding qualified registrars to perform EOD coding on the backlog of cases, the project is slightly behind schedule for SEER EOD coding and for reclassifying cases to AJCC stage. However, we expect to complete this phase of the project during Year 03. Follow-back to physicians for first course of treatment data has been delayed due to unforseen computer software deficiencies. The software specifications and development have been completed and the software is currently undergoing beta testing. Physician follow-back will become functional during Year 03. Finally, linkage activities are on schedule. These activities have resulted in one presentation to a professional society and one paper accepted for publication in a scientific journal.

REFERENCES

1. National Institutes of Health. Summary Staging Guide - April 1977. U.S. Department of Health, Education, and Welfare, Public Health Service, Bethesda, Md., 1977

2. Shambaugh EM, Ries LG, Young JL, Kruse MA, Plattz CE, Ryan RF, and Weiss MA. SEER Extent of Disease 1988 Codes and Coding Instructions, Second Edition, National Cancer Institute, National Institutes of Health, NIH Publication No. 92-2313, Bethesda, MD, 1992

3 Beahrs OH, Henson DE, Hutter RVP, and Kennedy BJ (eds.) American Joint Committee on Cancer Manual For Staging of Cancer - Fourth Edition, J.B., Lippincott Company, Philadelphia, 1992.

CORRECTION RECORD

PROCESSING SPECIFICATIONS

DRAFT

November 1, 1996

The following changes were suggested at the Corrections Report Specifications Sub-committee meeting on October 2nd and approved on the Corrections Task Force Teleconference on October 28, 1996.

Processing Procedures and Specifications for Applying Correction Records to the Data Base

These procedures and specifications apply only to the backlog of correction files, those that are records version A, B, C or D.

Pre-Processing Procedures:

1. All backlog correction files will be reformatted to the record version D record layout format (C/Net version 2.6). The file creation data will be added to the end of each record in the file and will be used to approximate the date the correction was created since the correction date field may be blank in some records. Since the order the record is written to the file is important for processing it is recommended that each unique record be numbered sequentially. A DOS program is being developed to accomplish this task.

2. Data items in the correction records will be converted to coding procedure 16 either before or during the time the files are processed. For example, the following correction under version C:

Correction Data Item	Correction Value
Surgery Summary	02

would become three corrections:

Correction Data Item	Correction Value
Surgery Summary	00
Surgery Summary-NCD	02
Surgery Summary-Recon	0

Specifications will be written to convert the data items in the correction files.

3. The correction files will be linked to the database to obtain the Region Patient Number and Region Tumor Number for the patient and tumor that applies to each correction record. The Region Patient Number and Region Tumor Number will be inserted back into the correction record.

Processing Procedures:

1. The correction files will be combined into one file and sorted by region patient number, correction creation date, hospital number, region tumor number and correction record number. The file will then be processed. This will allow the records to be processed in patient order by correction date starting with the earliest date. This should alleviate the need to pull abstracts for the same patient more than once. An audit trail should be kept of any corrections automatically applied to the database. This can be accomplished by indicating the data item that was "changed per correction record" in the Comments or Remarks text fields.

Post-Processing Procedures:

1. Since the corrections may change key linkage variables such as name, date of birth, and social security number, it is recommended that a linkage program be run against the full database after all corrections have been applied to identify any false negative matches.

Specifications for applying the correction value to the data base:

Since the CANDIS, ANEW, and CRIS systems process and store their data differently, these specifications are meant to be general enough to provide guidance for all three systems.

When processing the correction file it is assumed that the value for the correction data item will be compared to its database value/ If the values are the same then the correction is ignored. If the correction value differs from the database value, the correction value is applied to the database according to these specifications.

The specifications for updating the database value with the correction value are indicated by data item. for some data items two levels of specifications are given and are indicated as "Abs" and "Con". The "Abs" specification should be used when only one source (abstract) exists for the patient and/or tumor (depending on the data item). The "Con" specification should be used when multiple source (abstracts) exist for the specific patient or tumor set that matches the correction record.

For some data items the specification states "manual review". For other data items the specification states "list for review" or states "automatically update and list for review". "Manual Review" implies that the patient's abstract(s) must be reviewed before a decision is made to apply the correction. "List for Review" implies that the correction value and the database value should be examined before a decision is made to apply the correction. In most cases the patient's abstract(s) will not need to be examined. "Automatically Update and List for Review" implies that on rare occasions an update of this data item may cause an edit inconsistency in which case the edit inconsistency should be printed for resolution.

Any correction for which the specification states "List for Review" or "Update and list for review" will produce a listing which will include the case identifiers, correction information, and existing database information. Case identifiers will include the regional patient number, last name, and first name for patient level corrections, as well as regional tumor number and site for tumor level corrections, and hospital number for admission level corrections. Correction information will include the correction creation date, the correction item name, the correction item value, and correction remarks. Database information will include the existing database value for the item being corrected, and in some cases, additional database information which may facilitate the processing of the correction without review of an abstract.

Patient Information
(at the patient level)

Last Name

Abs: Automatically update
Add the old Last Name to the AKA file as an alias last name if it does not exist
Regenerate NYSIIS-NAME

Con: If the correction Last Name exists in the AKA file
then ignore the correction
else add old name to AKA,
update and list for review the correction value, the database value and all AKA values for last name, maiden name, middle name, first name, and patient date of last contact

First Name

Abs: Automatically update and list for review any first-name/sex inconsistencies
Add the old First Name to the AKA file as an alias first name if it does not exist

Con: Automatically update if first character of database value = first character of correction value and characters 2-14 of database value are blank and 2-14 of the correction value are not blank.
Else if the correction First Name exists in the AKA file
then ignore the correction
~~else add the correction First Name to the AKA file as an alias first name~~
Else add old first name in AKA file and
update and list for review the last name, first name, middle name, maiden name and date of last patient contact.

Middle Name

Abs: Automatically update and add old middle name to AKA first name.

Con: Automatically update if database value is blank and correction value is not blank.
Automatically update if first character of database value = first character of correction value and characters 2-14 of database value are blank and 2-14 of the correction value are not blank.
Ignore if the correction value is blank and the database value is not blank
Ignore if the correction matches first Name or AKA First Name
Else add to AKA file as an AKA First Name and update and list for review the last name, middle name, maiden name, and date of last patient contact.

Alias Last Name

Add to the AKA file as an alias last name if it does not exist in the AKA file as a last name or maiden name and automatically update and list for review at a later time to ensure it is not a first name or a last name suffix.
(List at a later time = not done by corrections programs)
Generate NYSIIS-NAME

Alias First Name

Ignore if equal to First Name
Else add to AKA file as a First Name if it odes not exist in the AKA file.

Maiden Name

Ignore if equal to Last Name
Else add to the AKA file as a maiden name
Generate NYSIIS-NAME

Name Suffix

Abs: Automatically update

Con: Automatically update if database value is blank
~~Else list for review~~
Else Update and List For Review

Social Security Number

Abs: Automatically update if database value is blank or 9's and correction value is not blank or 9's
Else ignore if Follow-up Source on database = 26 or 56 (Information from death clearance)
Else automatically update

Con: Automatically update if database value is blank or 9's and correction value is not blank or 9's
Else ignore if Follow-up Source on database = 26 or 56
~~Else automatically update if database value is blank or 9's and correction value is not blank or 9's~~
Else ~~list for review~~
Else ignore if correction value = blank or 9's
Else ignore is correction suffix = "D"
Else automatically update ans list for review
Note: Any time social security number is changed, program will list for review any existing patient records with the same social security number

Social Security Number Suffix

Automatically update if Social Security Number is updated
Else auotmatically update if correction comes in without correction to social security number
and Follow-up Source on database not = 26 or 56
and database social security number is not blank or 9's.

Birthplace

Abs: ~~Ignore if Follow-up Source on database = 26 or 56~~
~~Else automatically update~~
Automatically update if
1. database value is 999 OR
2. database value is 000 and correction value is 001-099

Else ignore if Follow-up Source on database = 26 or 56.

Con: Automatically update if
1. database value is 999 OR

2. database value is 000 and correction value is 001-099

Else ignore if Follow-up Source on database = 26 or 56

~~Else automatically update if~~

~~1. database value is 999 OR~~

~~2. database value is 000 and correction value is 001-099~~

Else ~~list for review~~ automatically update and list for review any birthplace/ race or birthplace/spanish origin inconsistencies.

Date of Birth

Abs: Ignore if Follow-up Source on database = 26 or 56
Else automatically update and list for review dob, site, marital status, date-dx, histology, and any edits or date conflicts
Recalculate Age at Diagnosis and Age Group and list for review any age/marital status or age/site inconsistencies

Cons: (Same as Abs.)
Ignore if Follow-up Source on database = 26 or 56
Else automatically update and list for review dob, site, marital status, date dx, histology, and any edits or date conflicts ~~if any part (month, day, year) or the database value is unknown and the other parts of both values are equal~~
Recalculate Age at Diagnosis and Age Group and list for review any age/marital status or age/site inconsistencies
~~Else manual review~~

Race

Ignore if Follow-up Source on database = 26 or 56
Else automatically update if
1. database value is 99 and correction value is 00-98 OR
2. database value is 96 and correction value is 04-06 or 08-14 OR
3. database value is 97 and correction value is 07 or 20-32

and list for review birthplace, race, spanish origin and any Race/Birthplace inconsistencies
Else manual review

Spanish-Origin

~~Manual review~~
List for review last name, maiden name, birthplace, race

Sex

Automatically update if database value is 9 and correction value is not 9 and list for review any site/sex or first-name/sex inconsistencies
Else manual review

Patient Information
(at the upper level)

Marital Status

Abs: Automatically update and list for review any age/marital status inconsistencies

Con: Automatically update if the correction record is from a class 0-2 case and
1. the database value is 9 and the correction value is not 9 OR
2. the database value is 1 and the correction value is 2-5

List for review any age/marital status inconsistencies
Else ignore

Occupation - Text

Abs: Automatically update
Reset OCCUP-80 and OCCUP-90 to 9999

Con: Automatically update if the database value is blank or "NR" or "Retired" and reset OCCUP-80 and OCCUP-90 to 9999
Else list for review at a later time (later time = not done by corrections program)

Industry - Text

Abs: Automatically update
Reset INDUS-80 and INDUS-90 to 9999

Con: Automatically update if the database value is blank or "NR" and reset INDUS-80 and INDUS-90 to 9999
Else list for review at a later time (later time = not done by corrections program)

Religion

Abs: Automatically update

Con: Automatically update if
1. the database value is 00 or 99 and correction value is not 00 or 99 OR
2. the database value is 20 and the correction value is 10-70

Else ignore

DX Address

Run address standardization on correction value before comparing it to the database value, If values differ then ~~Manual review~~ list for review dx address, dxcity, dxstate, dxzip, dxcounty.

DX City

Run city variant conversion on correction value before comparing it to the database value, If values differ then ~~Manual review~~ list for review dx address, dxcity, dxstate, dxzip, dxcounty.

DX State

Manual review

DX Zip

~~Manual review~~ list for review dx address, dxcity, dxstate, dxzip, dxcounty.

DX County

Manual review

Tumor Information
(at the tumor level)

Sequence Number

Ignore if database value = '00' and correction value = '01'
Else update and list for review (include correction remarks).

Date of Diagnosis

Manual review

Site - ICDO2

Manual review

Site - ICDO1

Manual review

Laterality

Ignore if laterality not required for site
Else Manual review

Histology - Type

Manual review

Histology - Behavior

Manual review

Histology - Differentiation

Automatically update if correction hist type = database hist type and database value = 9 and correction value = 1-4
Else Manual review

Summary Stage

If DATEDX Year < 1994 then manual review
Else ignore

Tumor Size

Ignore if DATEDX year prior to 1994 or unknown
Else manual review

Direct Extension

Ignore if DATEDX year prior to 1994 or unknown
Else manual review

Direct Extension - Pathology

Ignore if DATEDX year prior to 1995 or unknown
Else manual review

Lymph Node Summary

Ignore if DATEDX year prior to 1994 or unknown
Else manual review

Nodes Positive

Ignore if DATEDX year prior to 1994 or unknown
Else manual review

Nodes Examined

Ignore if DATEDX year prior to 1994 or unknown
Else manual review

Pediatric Stage

Automatically update.

Pediatric Stage Coder

Automatically update.

Pediatric Stage System

Automatically update.

Residual Tumor

Abs: Automatically update

Con: Automatically update if the admission record that matches the correction record has the more definitive value for surghosp than all other admission records for that tumor
Else Ignore

Diagnostic Confirmation

Abs: Automatically update and list for review any diagnostic confirmation interfield edit errors

Con: Automatically update if correction value , database value and list for review any diagnostic confirmation interfield edit errors

Type of Reporting Source

Abs: Automatically update and list for review any typerep interfield edit errors

Con: Automatically update if appropriate based hierarchy 1,4,5,3

Tumor Markers

Abs: Automatically update at the admission and tumor level

Con: automatically update at the admission level and apply consolidation rules at the tumor level

Treatment Information
(at the tumor and admission level)

Surgery - consider the following items as a group and apply all or none accordingly. (Though not all items will be found in the backlog of correction records, because the correction records are converted to coding procedure 16 before applying, it is most likely there will be converted correction values for the new data items.)

Date of Surgery
Date of Surgery - Non-Cancer Directed
Surgery Summary
Surgery Summary - Non-Cancer Directed
Surgery summary - Reconstructive
Surgical Approach
Surgery at this Hospital
Surgery at this Hospital - Non-Cancer Directed
Surgery at this Hospital - Reconstructive
Reason for No Surgery

1. If any of the data items SURG-APPROACH, SURG-HOSP, SURG-HOSP-NCD, SURG-HOSP-RECON are the only corrections in the group (ie. the correction is changing the type of surgery done at the hospital) then:

   Automatically update if values are consistent with treatment summary values (ie. no surgery/surghosp interfield edit errors)
   Else manual review

2. If DATE-SURG and/or DATE-SURG-NCD are the only corrections in the group (ie. the corrections only changing the date of surgery) then:

   Abs: Automatically update if
   1. the correction date value is replacing 9's in the database date value and known parts of the correction date and the database date are equal OR
   2. the correction date is with four months of Diagnosis Date and the correction produces no surgery or date interfield edit errors.
   Regenerate Date of Therapy if needed.
   Else manual review

Con: Automatically update if
1. the correction date value is replacing 9's in the database date value and known parts of the correction date and the database date are equal and the correction produces no surgery or date interfield edit errors.
Regenerate Date of Therapy and Radiation Sequence if needed.
Else manual review

3. If the corrections in the group contain DATE-SURG AND surg-sum (and possibly other surgery variables) and the correction DATE-SURG NOT = 0'S AND THE DATABASE date-surg = 0's (ie. the correction is adding surgical treatment):

   Automatically update if
   1. the correction DATE-SURG is within four months of Date-Dx OR

2. the Date of Therapy = 0's

and all surgery and date fields are consistent (no interfield edit errors).
Regenerate Date of Therapy and Radiation Sequence if needed.
Add "Surgery added per correction record" to Text-Surg field. Do not overwrite any text already in the field.
Else manual review.

4. If the corrections in the group contain DATE-SURG AND SURG-SUM (and possibly other surgery variables) and the correction DATE_SURG = 0's and the database DATE-SURG not = 0's (ie. the corrections deleting surgical treatment):

Manual review

5. For any other combinations of variables in the group (ie. the correction is changing the type of surgical treatment that was given):

Abs: Manual review

Con: Manual review if the consolidated surgery was derived from the abstract to which this correction applies
Else ignore.

Radiation - consider the following items as a group and apply all or none accordingly.

Date of Radiation
Radiation summary
Radiation to CNS Summary
Radiation at this Hospital
Radiation to CNS at this Hospital
Reason for No Radiation
Radiation/Surgery Sequence

1. If RAD-HOSP and/or RADCNS-HOSP are the only corrections in the group (ie. the correction is changing the type of radiation done at the hospital) then:

Automatically update if values are consistent with treatment summary values (ie. no radsum/radhosp interfield edit errors)
Else manual review

2. If DATE-RAD is the only correction in the group (ie. the correction is only changing the date of radiation) then:

Abs: Automatically update if
1. the correction date value is replacing 9's in the database date value and known parts of the correction date and the database date are equal OR
2. the correction date is within four months of Diagnosis Date

and the correction produces no radiation or date interfield edit errors.
Regenerate Date of Therapy and Radiation sequence if needed.
Else manual review

Con: Automatically update if

1. the correction date value is replacing 9's in the database date value and known parts of the correction date and the database date are qual

and the correction produces no radiation or date interfield edit errors.
Regenerate Date of Therapy and Radiation Sequence if needed.
Else manual review

3. If the corrections in the group contain DATE-RAD and RAD-SUM (and possibly other radiation variables) and the correction DATE-RAD not = 0's and the database DATE-RAD = 0's (ie. the correction is adding radiation treatment):

Automatically update if

1. the correction DATE-RAD is within four months of Date-Dx OR
2. the Date of Therapy = 0's

and all radiation and date fields are consistent (no interfield edit errors).
Regenerate Date of Therapy and Radiation Sequence if needed.
Add "Radiation added per correction record" to Text-Radiation field. Do not overwrite any text already in the field.
Else manual review

4. If the corrections in the group contain DATE-RAD and RD-SUM (and possible other radiation variables) and the correction DATE-RAD = 0's and the database DATE-RAD not= 0's (ie. the correction is deleting radiation treatment):

Manual review

5. For any other combinations of variables in the group (ie. the corrections changing the type of radiation treatment that was given):

Abs: Manual review

Con: Manual review if the consolidated radiation was derived from the abstract to which this correction applies
Else ignore.

Chemotherapy - consider the following items as a group and apply all or none accordingly.

Date of Chemotherapy
Chemotherapy Summary
Chemotherapy at this Hospital
Reason for No Chemotherapy

1. If CHEMO-HOSP is the only correction in the group (ie. the correction is changing the type of chemotherapy given at the hospital) then:

   Automatically update if the value is consistent with treatment summary values (ie. no chemosum/chemohosp interfield edit errors)
   Else manual review

2. If DATE-CHEMO is the only correction in the group (ie. the correction is only changing the date of chemotherapy) then:

   Abs: Automatically update if
   1. the correction date value is replacing 9's in the database date value and known parts of the correction date and the database date are equal OR
   2. the correction date is with four months of Diagnosis Date

   and the correction produces no chemotherapy or date interfield edit errors.
   Regenerate Date of Therapy if needed.
   Else manual review

   Con: Automatically update if
   1. the correction date value is replacing 9's in the database date value and know parts of the correction date and the database date are equal

   and the correction produces no chemotherapy or date interfield edit errors.
   Regenerate Date of Therapy if needed.
   Else manual review

3. If the corrections in the group contain DATE-CHEMO and CHEMO-SUM (and possible other chemotherapy variables) and the correction DATE-CHEMO not = 0's and the database DATE-CHEMO = 0's (ie. the correction is adding chemotherapy):

   Automatically update if
   1. the correction DATE-CHEMO is within four months of Date-Dx OR
   2. the Date of Therapy = 0's

   and all chemotherapy and date fields are consistent(no interfield edit errors).
   Regenerate Date of Therapy if needed.
   Add "Chemotherapy added per correction record" to Text-Chemotherapy field.
   Do not overwrite any text already in the field.
   Else manual review.

4. If the corrections in the group contain DATE-CHEMO and CHEMO-SUM (and possible other chemotherapy variable) and the correction DATE-CHEMO = 0's and the database DATE-CHEMO not = 0's (ie. the correction is deleting chemotherapy):

   Manual review

5. For any other combinations of variables int he group (ie. the correction is changing the type of chemotherapy that was given):

   Abs: Manual review

   Con: Manual review if the consolidated chemotherapy was derived from the abstract to which this correction applies
   Else ignore.

Hormone Therapy - consider the following items as a group and apply all or none accordingly.

Date of Hormone Therapy
Hormone Therapy Summary
Hormone Therapy at this Hospital
Reason for No Hormone Therapy

1. if HORM-HOSP is the only correction is the group (ie. the correction is changing the type of hormone therapy given at the hospital) then:

   Automatically update if the value is consistent with treatment summary values (ie. no hormsum/hormhosp interfield edit errors)
   Else manual review

2. if DATE-HORM is the only correction is the group (ie. the correction is only changing the date of hormone therapy) then:

   Abs: Automatically update if
   1. the correction date value is replacing 9's in the database date value and known parts of the correction date and the database date are equal OR
   2. the correction date is within four months of Diagnosis Date

   and the correction produces no hormone therapy or date interfield edit errors.
   Regenerate Date of Therapy if needed.
   Else manual review

   Con: Automatically update if
   1. the correction date value is replacing 9's in the database date value and known parts of the correction date and the database date are equal

   and the correction produces no hormone therapy or date interfield edit errors.
   Regenerate Date of Therapy if needed.
   Else manual review

3. If the corrections in the group contain DATE-HORm and HORM-SUM (and Possible other hormone therapy variables) and the correction DATE-HORM not = 0's and the database DATE-HORM = 0's (ie. the correction is adding hormone therapy)"

   Automatically update if
   1. the correction DATE-HORM is with four months of Date-Dx OR
   2. the Date of Therapy = 0's

   and all hormone therapy an date fields are consistent (no interfield edit errors).

Regenerate Date of Therapy if Needed.
Add "Hormone therapy added per correction record" to Text-Hormone field
Do not overwrite any text already in the field.
Else manual review

4. If the corrections in the group contain DATE-HORM and HORM-SUM (and possible other hormone therapy variables) and the correction DATE-HORM = 0's and the database DATE-HORM not = 0's (ie. the correction is deleting hormone therapy):

   Manual review

5. For any other combinations of variables in the group (ie. the correction is changing the type of hormone therapy that was given):

   Abs: Manual review

   Con: Manual review if the consolidated hormone therapy was derived from the abstract to which this correction applies
   Else ignore

Immunotherapy - consider the following as a group and apply all or none accordingly.

Date of Immunotherapy
Immunotherapy Summary
Immunotherapy at this Hospital

1. If IMMUNO-HOSP is the only correction in the group (ie. the correction is changing the type of immunotherapy given at the hospital) then:

   Automatically update if the value is consistent with treatment summary values (ie. no immunosum/immunohosp interfield edit errors)
   Else manual review

2. if DATE-IMMUNO is the only correction is the group (ie. the correction is only changing the date of immunotherapy) then:

   Abs: Automatically update if
   1. the correction date value is replacing 9's in the database date value and known parts of the correction date and the database date are equal OR
   2. the correction date is within four months of Diagnosis Date

   and the correction produces no immunotherapy or date interfield edit errors.
   Regenerate Date of Therapy if needed.
   Else manual review

   Con: Automatically update if
   1. the correction date value is replacing 9's in the database date value and known parts of the correction date and the database date are equal

   and the correction produces no immunotherapy or date interfield edit errors.
   Regenerate Date of Therapy if needed.
   Else manual review

3. If the corrections in the group contain DATE-IMMUNO and IMMUNO-SUM (and possibly IMMUNO-HOSP) and the correction DATE-IMMUNO not = 0's and the database DATE-IMMUNO = 0's (ie. the correction is adding immunotherapy):

Automatically update if
1. the correction DATE-IMMUNO is with four months of Date-Dx

OR

2. the Date of Therapy = 0's

and all immunotherapy an date fields are consistent (no interfield edit errors).
Regenerate Date of Therapy if needed.
Add "Immunotherapy added per correction record" to Text-Immunotherapy field.
Do not overwrite any text already in the field.
Else manual review

4. If the corrections in the group contain DATE-IMMUNO and IMMUNO-SUM (and possibly IMMUNO-HOSP) and the correction DATE-IMMUNO = 0's and the database DATE-IMMUNO not = 0's (ie. the correction is deleting immunotherapy):

Manual review

5. For any other combinations of variables in the group (ie. the correction is changing the type of immunotherapy that was given):

Abs: Manual review

Con: Manual review if the consolidated immunotherapy was derived from the abstract to which this correction applies
Else ignore

Other Therapy - consider the following items as a group and apply all or none accordingly.

Date of Other Therapy
Other Therapy Summary
Other Therapy at this Hospital

1. If OTHER-HOSP is the only correction in the group (ie. the correction is changing the type of other therapy given at the hospital) then:

Automatically update if the value is consistent with treatment summary values (ie. no othersum/otherhosp interfield edit errors)
Else manual review

2. if DATE-OTHER is the only correction is the group (ie. the correction is only changing the date of other therapy) then:

Abs: Automatically update if
1. the correction date value is replacing 9's in the database date value and known parts of the correction date and the database date are equal OR
2. the correction date is within four months of Diagnosis Date

and the correction produces no other therapy or date interfield edit errors.
Regenerate Date of Therapy if needed.
Else manual review

Con: Automatically update if

1. the correction date value is replacing 9's in the database date value and known parts of the correction date and the database date are equal

and the correction produces no other therapy or date interfield edit errors.
Regenerate Date of Therapy if needed.
Else manual review

3. If the corrections in the group contain DATE-OTHER and OTHER-SUM (and possibly OTHER-HOSP) and the correction DATE-OTHER not = 0's and the database DATE-OTHER = 0's (ie. the correction is adding other therapy):

Automatically update if

1. the correction DATE-OTHER is with four months of Date-Dx OR
2. the Date of Therapy = 0's

and all other therapy an date fields are consistent (no interfield edit errors).
Regenerate Date of Therapy if needed.
Add "Other therapy added per correction record" to Text-Other therapy field.
Do not overwrite any text already in the field.
Else manual review

4. If the corrections in the group contain DATE-OTHER and OTHER-SUM (and possibly OTHER-HOSP) and the correction DATE-OTHER = 0's and the database DATE-OTHER not = 0's (ie. the correction is deleting other therapy):

Manual review

5. For any other combinations of variables in the group (ie. the correction is changing the type of other therapy that was given):

Abs: Manual review

Con: Manual review if the consolidated other therapy was derived from the abstract to which this correction applies
Else ignore

Admission Information
(at the admission level)

Hospital Number

Manual review

Accession Number

Automatically update

Year First Seen

Automatically update

Medical Record Number

Automatically update

Date of First Admission

Automatically update and list for review any date admission interfield edit errors

Date of First Discharge

Automatically update and list for review any date discharge interfield edit errors

Physician - Attending

Automatically update if correction value is a valid MD code (no edit errors) and move old value to Physician-Other field else ~~list for review~~ ignore

Physician - Referring

Automatically update if correction value is a valid MD code (no edit errors) and move old value to Physician-Other field else ~~list for review~~ ignore

Physician - Surgeon

Automatically update if correction value is a valid MD code (no edit errors) and move old value to Physician-Other field else ~~list for review~~ ignore

Physician - Medical Oncologist

Automatically update if correction value is a valid MD code (no edit errors)
Else ~~list for review~~ ignore

Physician - Radiation Oncologist

Automatically update if correction value is a valid MD code (no edit errors)
Else ~~list for review~~ ignore

Physician - Other

Automatically update if correction value is a valid MD code (no edit errors)
Else ~~list for review~~ ignore

Class of Case

Automatically update and list for review any class interfield edit errors

Hospital From

Automatically update and list for review class, hospital number, and any hospfrom/datedx/dateadm inconsistencies

Hospital To

Automatically update and list for review class, hospital number, and any hospto/datedx/dateadm inconsistencies

Casefinding Source

Automatically update

Payment Source

Automatically update

Payment Source - Text

Automatically update if Payment Source Text is blank or Payment Source is updated

Regional Data

Ignore (At the discretion of the region)

ACOS Information
(at the admission level)

TNM Coder - Clinical

Automatically update

TNM Coder - Path

Automatically update

TNM Edition

Automatically update

TNM T Code - Clinical
- Path

Automatically update

TNM N Code - Clinical
- Path

Automatically update

TNM M Code - Clinical
- Path

Automatically update

TNM Staging Basis

Automatically update

TNM Stage - Clinical
- Path

Automatically update

Estimation of Case Ascertainment by Linkage With Medicare Files

ALLEN ME[1]*, WRIGHT WE[2], PERKINS CI[2].
CA Public Health Foundation[1], CA Dept Health Services[2].

A linkage was performed between a cohort of 7,340 patients provided by the Health Care Financing Administration (HCFA) of women 65 years of age or older with addresses in California who received treatment for breast cancer in 1993 in a hospital or ambulatory care facility and 188,021 female breast cancers submitted to the statewide, population-based California Cancer Registry (CCR) in October, 1995. Case ascertainment for 1993 was estimated to be 96.7% complete at the time of linkage. The purpose of the linkage was to investigate its utility for case ascertainment and for obtaining data not normally abstracted from the medical record, such as co-morbidities and payment source. Using the software AUTOMATCH, a total of 7,040 (95.9%) Medicare patients were matched to cases on the CCR (96.8% of the hospital patients and 94.2% of patients from ambulatory care facilities). Follow-up is underway on the 300 (4.1%) Medicare patients not identified on the CCR. It has already been determined that approximately one third of these individuals received treatment outside of California. By the time of the conference, follow-up will have been completed at the regional registries and treatment facilities. Completeness of case ascertainment will be examined by such factors as race/ethnicity, age, type of reporting facility and stage at diagnosis and linkage strategies and results will be discussed in detail.

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Managed Care and Treatment for Early Stage Breast Cancer: California Medicare, 1993

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Abstract

The rapid increase of California Medicare beneficiaries enrolled in managed care in recent years has led to great interest in the patterns and quality of care received by those beneficiaries. We compared treatment for early stage breast cancer among HMO enrollees (risk and cost contracts) with traditional fee-for-service (FFS) beneficiaries. Initial treatment data for 10,050 California Medicare beneficiaries treated for early stage breast cancer in 1993 were obtained from the California Cancer Registry. These data were linked to type of Medicare coverage from the Medicare beneficiary database. Bivariate and multivariate methods were used to model the relationships between type of coverage and treatment, controlling for clinical and demographic cofactors. We found women enrolled in HMOs with Medicare cost contracts were slightly more likely, and women enrolled with Medicare risk contracts were slightly less likely, than FFS beneficiaries to receive breast conserving surgery. However, regional variations in breast treatment were larger than coverage differences, suggesting other influences on patterns of treatment. We also found lower utilization of conservative surgery among Asian women in this population. Linking Medicare data with cancer registries provides the basis for exploring the effects of managed care and other variables on cancer treatment. 196 words

The dramatically transformed incentives associated with capitated managed care have spurred payers, purchasers, consumers, and government agencies to take a great interest in the resulting quality of health care. Within the Medicare program, extensive billing data has been used to observe patterns of care received by most Medicare beneficiaries. However, this data is limited to Medicare beneficiaries within the traditional fee-for-service (FFS) system; there is no comparable source of data for Medicare's capitated health maintenance organization (HMO) enrollees. This lack of information is especially important in California, a state with a relatively large, and rapidly increasing, number of Medicare beneficiaries enrolled in HMOs. In 1992, 25% of the California Medicare beneficiaries were enrolled in an HMO; by 1995 this percent had increased to 37% of beneficiaries (HCFA Denominator File, unpublished tabulation). As a result, vital records, hospital discharge files, disease-specific registries, and other companion sources of data which include HMO enrollees are becoming increasingly valuable for monitoring the health care received by California Medicare beneficiaries.

Several studies have examined patterns of care delivered to both public and commercial HMO members[1-4]. Recent data from the Medical Outcomes Study indicate that elderly patients enrolled in managed care experienced greater declines in functional status than those not enrolled in managed care [1]. A 1994 review of managed care by Miller and Luft found that HMO enrollees had, on average, significantly shorter hospital stays and lower utilization of expensive or discretionary services than those with FFS coverage [2]. Yet, for the most part, they found HMO enrollees and patients with FFS insurance experienced comparable quality of care, as measured by a variety of outcome or process measures. However, the studies included in

Miller and Luft's analysis were not consistent; while the majority of the findings supported equivalent or better care for HMO enrollees, some studies suggested that HMO enrollees in certain situations received less adequate care [2].

Most of the previous studies that examined managed care were conducted using data from the 1980's. The rapid changes in the health care environment, particularly in California, make observations from the 1980s less useful for current and future Medicare beneficiaries.

Medicare managed care is made more complicated by the two types of contracts negotiated between the Health Care Financing Administration (HCFA) and the managed care plans [5]. Under a Medicare cost contract, the health plan (not an individual physician) is paid by HCFA on FFS basis by submitting claims for services. In contrast, Medicare risk contracts capitate health plans at a fixed rate per member per month. In California and elsewhere, Medicare risk contracts are emerging as the most dominant [6]. In 1992, 32% of the California HMO beneficiaries were enrolled under a cost contract. By 1995, only 12% of HMO beneficiaries were enrolled under a cost contract (HCFA Denominator File, unpublished tabulations).

We used early stage breast cancer as an index condition to compare patterns of care within HMOs to traditional FFS coverage. From 1989 to 1993, over 40,000 women 65 or older were diagnosed with breast cancer in California [7]. These women accounted for 58% of all breast cancers and 54% of all breast cancer deaths in California [7]. Over 65% of older women diagnosed with breast cancer are diagnosed with an in situ or localized tumor, where the chance of survival is greatest. Indeed, despite the few studies done with older women, benefits of

treatment are similar for otherwise healthy older and younger post-menopausal women diagnosed at the same stage [8-12].

A recent study of Medicare beneficiaries diagnosed with cancer in the 1980's found that stage at diagnosis among breast cancer and many other cancers was similar or lower among Medicare HMO enrollees compared to the FFS group [13]. The authors concluded that screening efforts within managed care, for tumors with effective screening tests, contributed to these results. In another study, Lee-Feldstein and colleagues reported lower survival rates among Orange County breast cancer patients of all ages treated in an HMO hospital compared to patients treated in other local hospitals [14]. However, the Lee-Feldstein study was not limited to Medicare enrollees and could not separate managed care coverage for women not treated at the HMO hospital.

An NIH consensus conference concluded that breast conservation treatment (defined as excision of the primary tumor and adjacent breast tissue, followed by radiation therapy) is an appropriate method of primary therapy for early stage breast cancer [15]. The conference further concluded that conservative therapy is preferable because survival rates are comparable to those of total mastectomy while preserving the breast. Treatment patterns for early stage cancer are dependent on many patient-level [7, 16-19], geographic [7,20-22], and provider-level [16, 17, 20, 23, 24] characteristics. The impact of type of insurance coverage on choice of treatment for early stage breast cancer has not been examined.

The need for follow-up radiation therapy and the slight increased risk of recurrence are likely to make the total costs associated with breast conserving surgery (BCS) higher than with

less conservative surgery [25]. This extra cost could provide incentives for capitated organizations with fixed budgets to recommend more extensive surgery for their members with breast cancer. On the other hand, more coordinated care within an HMO, regardless of payment method, could lead to better follow-up and monitoring for breast cancer patients. Lee–Feldstein and colleagues reported lower use of BCS for women treated at HMO hospitals compared to women treated at teaching hospitals, however, small and large community hospitals also had a relatively low use of BCS [14]. Furthermore, surgery for managed care patients treated in other hospitals was not investigated.

In an effort to determine whether type of Medicare coverage had an effect on breast cancer treatment among Medicare beneficiaries, we linked Health Care Financing Administration (HCFA) data to 1993 breast cancer cases identified by the California Cancer Registry (CCR). We specifically examined the relationship between breast surgery and Medicare coverage type (FFS, Medicare cost HMO, Medicare risk HMO) among Medicare beneficiaries diagnosed with early stage breast cancer. We further investigated whether the association between type of Medicare coverage and breast cancer surgery differed by selected patient characteristics.

Methods

Data from the California Cancer Registry (CCR) was used to identify 15,753 California women 65 years of age or older, diagnosed with their first tumor, and who had had treatment for breast cancer in 1993. The CCR maintains a file of all tumors diagnosed in California, along with diagnoses, treatment, and demographic characteristics of the person diagnosed with cancer [7]. To get specific information about the Medicare coverage of these women, we merged the

CCR data to the HCFA's national Medicare enrollment file using a previously published algorithm [26]. Of the 15,753 women in the CCR, 14,901 were matched in the HCFA database. The remainder include those not eligible for Medicare. We used data from the 1990 United States Census [27] to characterize the socio economic environment of each woman's surrounding neighborhood, based on residence zip code. Only 318 women had unmatchable zip codes, primarily due to residence outside of California, and were excluded. This exclusion left 14,583 women eligible for our study.

Because our intention was to compare the utilization of breast conserving surgery and mastectomy, our analysis targeted women with early stage breast cancer who underwent surgery. Women who did not have any surgery for their tumor (339), had only needle incisions (375), or were missing surgery information (219) were excluded. After these exclusions, 13650 women were eligible for analysis.

Using the Surveillance, Epidemiology, and End Results (SEER) Summary Stage criteria [28], 171 (1.3%) of the women in the study population were missing or had unstaged tumors; 1,457 (10.7%) were diagnosed with in situ tumors; and 8,593 (63.0%) were diagnosed with localized tumors. The remaining 3,429 (25.1%) had regional or distant tumors. Our analysis was limited to the 10,050 women with early stage (localized or in situ) tumors.

Most of the 339 women excluded previously for having no breast cancer surgery recorded by the CCR were diagnosed with distant (34.3%) or unknown/unstageable (42.3%) tumors; nearly all of the 375 women excluded previously for missing surgery data were also missing

stage at diagnosis (96.4%); of the 375 women who had needle incisions, 63.4 had regional or distant tumors and 22.5% had unknown/unstaged tumors.

Initial cancer-directed surgery was coded by the CCR and categorized into two groups: breast conserving surgery (BCS) and mastectomy, regardless of axillary lymph node dissection or breast reconstructive surgery.

Medicare HMO enrollment, as well as type of contract (cost or risk), was ascertained by comparing the date of diagnosis from the CCR data to the beginning and ending dates of group health organization participation from the HCFA beneficiary data file.

Multiple logistic regression models were used to examine the relationships between BCS and Medicare coverage, adjusting for several potential confounding factors: marital status, age (categorical or continuous), and ethnicity (African American, Asian, White, Latina, Other/Unknown) from the CCR file; and, median income and rural area from the census file. The rural area variable was divided into two groups, no rural area versus some rural area; however, this variable was also examined in other forms. To assess geographic differences, we classified each woman's county of residence into the corresponding region defined by the California Cancer Registry [7].

We also tested whether the relationship between Medicare coverage and breast surgery varied by levels of cofactors. First, separate bivariate analyses of Medicare coverage and breast surgery were examined at each level of each factor. This analysis was followed by adding interaction terms to the logistic regression model to control for potential confounding.

Finally, we assessed the potential impact of tumor size on our findings and our ability to further investigate the relationship between follow-up radiation therapy and Medicare coverage.

Results

Among our 1993 cohort of women with early stage breast cancer, 20% (2027) were enrolled in a Medicare risk HMO and 8.5% (856) were enrolled in a Medicare cost HMO (Table 1). In general, the Medicare HMO populations were somewhat younger than the FFS population, less likely to live in a rural area, and more likely to live in areas with higher median incomes (Table 1). We also found wide regional variation in HMO enrollment and type of HMO contract. For example, the Bay Area region had a relatively high percentage of the HMO cost enrollees, but a small percentage of HMO risk enrollees. Conversely, San Diego had a large number of HMO risk enrollees. Women with Medicare cost coverage were slightly more likely to be diagnosed with in situ tumors than those in Medicare FFS or Medicare risk HMO coverage ($p=.08$).

Overall, 47.6% (4783) of the women diagnosed with early stage breast cancer received breast conserving surgery. The difference in breast surgery by Medicare coverage was statistically significant, though small. Women enrolled in a Medicare risk HMO had the lowest use of BCS (44.3%) and women enrolled in a Medicare cost HMO had the highest use (55.0%) (Table 2). Women with Medicare FFS coverage were in the middle (47.6%).

However, there were many demographic factors related to BCS (Table 2). Younger and older women were more likely to receive BCS than those between 70 and 84. Asian women had the lowest use of BCS relative to other race/ethnicity groups. Never married women were the

least likely to have BCS, divorced women the most likely. Women treated with BCS lived in areas with median incomes higher than women treated with mastectomy ($38,700 vs.$37,200, p<.001).

The variation in BCS by region was somewhat greater than by Medicare coverage. Less than 40% of women in the Central or Santa Clara regions had BCS, compared to nearly 60% of women in the Bay Area. These data are comparable to the regional differences in BCS reported for earlier years by the CCR [7].

After adjustment for potentially confounding factors, including stage at diagnosis, women enrolled in a Medicare cost HMO remained slightly more likely than women remaining in FFS to have BCS (AOR=1.17, 95%CI 1.00-1.36) (Table 3). Conversely, women enrolled in a Medicare risk HMO had a lower use of BCS (AOR=.82, 95%CI .74-.91). The Hosmer-Lemeshow goodness-of-fit statistic for this model was 5.96 with 8 df (p=.65), suggesting no large deviations in fit.

This model also indicated large regional differences in breast cancer treatment, after adjustment for patient demographic factors and stage at diagnosis. As the largest region in California, Los Angeles was chosen as the reference category for logistic analysis. Women with breast cancer in Santa Clara, the Central region, and Orange County were significantly less likely to get BCS than women in Los Angeles. Conversely, women in the Bay Area were more likely to receive BCS. While a different region as reference would shift the odds ratios, the progression of regions with low BCS to those with high use of BCS, adjusted for insurance and demographic differences, would remain.

Asian women with breast cancer had the lowest use of BCS. Women in the Other/Unknown group had the highest use; though, it is difficult to draw conclusions since it contains less than 1% of our population. We found no difference in BCS among African American, Latina, and white women.

For the most part, findings from the regression model were comparable to the univariate analysis. With the exception of Medicare coverage and region, the unadjusted odds ratios for BCS were close to the adjusted odds ratios, suggesting minimal confounding between the demographic variables. The difference between the unadjusted and adjusted odds ratios among the regions suggests that factors related to region of residence are also related to choice of breast surgery.

Because the underlying use of BCS is near 50%, the odds ratios greatly overstate relative risks. The unadjusted relative risk of BCS for Medicare cost HMO coverage relative to FFS, for example, is 1.16 (55.0/47.6, Table 2), 14% lower than the unadjusted odds ratio (1.34, Table 3). The statistical significance and the directions of the associations are the same, however.

We explored several alternative specifications of the model, with primary attention to modification of the relationships between Medicare coverage and BCS. Log transformations and squared terms of the income variable did not materially improve the model. The best form of the rural area of residence variable was dichotomous: no rural area in the zip code versus some rural area. This result was indicated by the cross tabulations and confirmed in logistic models; continuous forms of this variable, as well as other categorizations, did not improve the fit of the model or change the relationship between Medicare coverage and surgery. Age was entered as a

categorical variable to capture the somewhat u-shaped relationship between age and surgery indicated in univariate analysis. Using age as a continuous variable, with or without a squared term to capture nonlinearities, did not improve the fit of the model nor change the relationship between Medicare coverage and cancer treatment.

Because we did not have individual level information on income or rural residence, we examined the impact of these census variables on our model. Elimination of these variables did not materially effect the relationships between Medicare coverage as diagnosis and breast cancer treatment, nor did this elimination decrease the overall fit as measured by the Hosmer-Lemeshow statistic. However, the -2 Log Likelihood statistic comparing these two models was 44.1 (2df, $p < .001$). This finding suggests that some measure of rural/urban or socio-demographic status is useful for describing breast cancer treatment in California.

Separate regressions, limited to Medicare coverage and one group of variables at a time, indicated that region, no rural area versus any rural area, and marital status primarily contributed to the modest difference in the unadjusted and adjusted odds ratios between Medicare coverage and BCS. Individual adjustment for stage at diagnosis, age, race/ethnicity, and income did not materially change the estimated odds ratios between Medicare coverage and BCS. This finding confirms the geographic influence on both Medicare coverage and BCS.

Next, we tested whether the relationship between Medicare coverage and breast surgery varied by levels of various factors. Interaction terms included in logistic regression models indicated that the relationship between Medicare coverage and breast surgery differed slightly by marital status, age at diagnosis, and geographic region of California. For many categories of

these variables, however, there were fewer than 50 women enrolled in either a Medicare risk or cost HMO, making inferences and comparisons questionable. Furthermore, most interaction terms indicated no relationship between Medicare coverage and choice of surgery.

However, there were some differences: women between 75 and 85, enrolled in a Medicare risk HMO, had lower rates of BCS than women of the same age group enrolled in FFS (age group 75-79 AOR=.60 95%CI .48-.75; age group 80-84 AOR= .79 95%CI .59-1.06). Women of other ages enrolled in a Medicare risk HMO had no statistically significant difference in treatment compared to Medicare FFS.

The relationship between Medicare coverage and breast surgery did not differ by stage at diagnosis (in situ or localized tumor), median income or urban/rural status of residential zip code. There were too few non-white women within each Medicare HMO group for valid comparisons by ethnicity.

For most of the cancer reporting regions in California, there were too few women within a Medicare cost HMO for valid estimates. Furthermore, in the 3 regions with sufficient numbers (Sacramento, Bay Area, and Los Angeles) we found no relationship between BCS and Medicare cost HMO versus FFS. In the 5 regions at least 50 women enrolled in a Medicare risk HMO, the relationship between BCS and Medicare risk varied: women in a Medicare risk HMO in Orange County had higher utilization of BCS compared to FFS, while women enrolled in a Medicare risk HMO in Los Angeles or Inland Empire region had a lower use of BCS (Table 3).

To assess the impact of additional clinical criteria for BCS on our results, we briefly compared the distribution of tumor size between the Medicare HMO and the FFS beneficiaries.

Over 16% of the women were missing tumor size information. The percent missing was higher among FFS women than HMO women (18% vs 13%, p=0.001). Of the remaining women, there was no significant difference between the distribution of tumor size by Medicare coverage or breast surgery. Fewer than 2% of women had tumors measuring greater than 5 cm; this did not differ by Medicare coverage.

To determine the feasibility of an additional analysis of radiation therapy among those treated with BCS, we compared the Medicare claims and the CCR data among the women with FFS coverage. The Medicare claims indicated that over one-third of the women in the CCR who had no reported radiation therapy following BCS, actually had some radiation treatment. Furthermore, 30% of the women who reported radiation therapy in the CCR data had no corresponding claim in the Medicare file. Because of these inconsistencies, we did not pursue additional analysis of radiation treatment following BCS.

Discussion

The associations between breast cancer treatment and type of Medicare coverage, though statistically significant, were small. Women enrolled in HMOs with Medicare cost contracts were slightly more likely, and women enrolled with a Medicare risk contract were slightly less likely, than FFS beneficiaries to receive breast conserving surgery. However, regional variations in breast treatment were larger, suggesting other influences on patterns of care.

Our finding in Orange County that enrollment in a Medicare risk HMO was associated with more BCS compared with FFS differs from the previous study in that area [14]. This difference can be explained, in part, by the different time periods investigated; our study

examined treatment in 1993, while the Lee-Feldstein study examined breast cancer in the late 1980's. The changing characteristics of beneficiaries enrolled in Medicare HMOs as well as the changing nature of Medicare HMO contracts (group model and network model) in recent years are also likely explanations for this difference. Given their study was published in 1993, it is unlikely that the practice patterns observed in our data are a result of that publication.

Our findings of associations between early breast cancer treatment and demographic factors are similar to those of other studies [16, 17]. For example, we found the use of BCS generally decreased with age and then increased again among women over 84 [7,17]. However, we found a lower use of BCS among women 75-79 enrolled in a Medicare risk HMO compared to women of the same age group enrolled in FFS. One possible explanation for this finding is the geographic differences found between Medicare risk HMO and FFS beneficiaries.

The relationship between ethnicity and BCS is inconsistent. Our results for African American and Latina women agree with other studies that found nonwhite women treated by BCS as often as white women [16, 22]. Using California data from 1988-1992, the CCR found Latina women with localized tumors had a significantly lower use of BCS relative to white women [7], though this difference was not significant among just the older population . They found no treatment differences among African American, Latina, and white women with in situ tumors. Nattinger and colleagues found black women had a slightly lower use of BCS than white women [21]. Ballard-Barbash and colleagues, found black women had a slightly higher use of BCS than white women; though this association disappeared when adjusted for various provider-level factors [17]. After adjustment for various demographic factors, regional

differences, and Medicare coverage, we found odds ratios for BCS by ethnicity close to the unadjusted estimates. Although the impact of insurance coverage on BCS could differ by ethnicity, we did not have a large enough number of beneficiaries to examine BCS and Medicare coverage within race/ethnicity groups.

We found that Asian women had a significantly lower use of BCS, even after controlling for various demographic factors and stage at diagnosis, consistent with earlier data from the CCR [7]. We found no other studies that examined BCS among Asian women with breast cancer. It is possible that patient education on treatment options has not been effective for Asian women, perhaps due to language or cultural barriers.

These analyses are limited by several factors. First, the Summary Stage coding of stage at diagnosis is not as useful for determining who is eligible for breast conserving surgery as the Extent of Disease (EOD) coding. More precise coding based on SEER Extent of Disease (EOD) coding was implemented by the CCR in 1994. Only half of the women in 1992 and 1993 had EOD variables recorded, limiting their utility for this analysis. Some of the women in this study may not have been eligible for breast conserving surgery based on tumor size or other EOD criteria not incorporated into the Summary Stage classification. And, some women with regional tumors may have been eligible for BCS but excluded from this analysis. However, we found no evidence that tumor size differed between the HMO and FFS beneficiaries, reducing the potential bias of the EOD criteria on the relationship between Medicare coverage and treatment.

The protocol for breast cancer treatment with breast conserving surgery is to follow-up the surgery with radiation treatment [15]. This additional treatment is one potential reason for

geographic differences in BCS; regions with fewer facilities for radiation follow-up may be less likely to perform BCS. Unfortunately, because of large inconsistencies in the CCR and the HCFA data among the FFS beneficiaries we could not examine complete adherence to this guideline by Medicare coverage. Further investigation of follow-up radiation therapy is important for older women, especially since the use of this additional treatment decreases with age [12, 17].

In addition, current reports show a moderate health advantage of Medicare HMO enrollees relative to those beneficiaries with FFS coverage[29-31]. This health differential limits the usefulness of unadjusted comparisons between patterns of care given to HMO and FFS beneficiaries. Although we adjusted for many demographic factors, we did not have additional data on health status or comorbidities which could potentially affect treatment pattern. Ballard-Barbash and colleagues examined the relationship between a summary comorbidity score and BCS and found comorbidities to have an independent effect on BCS [17]. However, inclusion of the comorbidity score in their multiple logistic regression model did not modify the odds ratios between BCS and age, race, education, or stage at diagnosis.

Our study demonstrated the usefulness of linking Medicare data with cancer registry data. Diagnostic, treatment, and in some cases demographic data are frequently more reliable in cancer registries, even for FFS beneficiaries. Surgery for early stage breast cancer is just one index for assessing the patterns of care received by Medicare beneficiaries diagnosed with breast cancer. Other indices that could be examined with this type of linkage would include risk-adjusted survival, functional status, timeliness and consistency of diagnostic tests and follow-up therapies,

and time from diagnosis to treatment. Most important, our linkage between cancer registry and Medicare files highlights the great potential for providing information on the evolving effect of capitated HMO enrollment on patterns, and eventually quality, of care.

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TABLE 1: Percent distribution of the study population (N=10050) by Medicare coverage type at diagnosis.

Factor	FFS (N=7167)	HMO cost (N=856)	HMO risk (N=2027)
	%	%	%
Region***			
Santa Clara Region	7.5	9.1	1.4
Central Region	8.6	2.2	.9
Sacramento Region	11.7	19.9	1.3
Tri-County Region	5.6	.6	3.2
Inland Empire Region	7.0	2.1	17.6
North Region	8.0	8.5	.4
San Diego Region	8.7	2.9	20.0
Bay Area Region	13.4	39.4	5.7
Los Angeles Region	21.9	13.2	36.6
Orange County Region	7.8	2.1	13.0
Stage at Diagnosis			
In situ	14.4	17.1	13.9
Localized	88.6	82.9	86.1
Race/Ethnicity***			
White	86.1	87.3	84.8
Black	3.3	5.5	3.4
Hispanic	6.1	4.3	7.7
Asian	3.8	2.3	3.3
Other/Unknown	.7	.6	.8
Age**			
65-69	28.3	27.9	31.0
70-74	27.6	30.6	28.4
75-79	21.8	24.7	21.6
80-84	13.6	11.0	11.7
>84	8.7	5.8	7.3
Marital Status***			
Never married	6.9	4.0	6.5
Married	44.9	50.2	46.3
Divorced	6.9	6.8	8.5
Widowed	39.8	34.6	36.7
Unknown	1.5	4.4	2.0
Median income ($1000s), mean (sd)**	37.7 (13.3)	39.3 (11.5)	38.0 (11.2)
Rural zip code area***			
None	55.8	63.3	69.3
Some	44.2	36.7	30.7

TABLE 2: Percent breast conserving surgery (BCS), and unadjusted and adjusted odds ratios (95% confidence intervals) from logistic regression model predicting the risk of breast conserving surgery (versus mastectomy).

Variable	% BCS	Unadjusted		Adjusted#	
		Odds Ratio	95% CI	Odds Ratio	95% CI
HMO vs FFS at diagnosis***					
FFS	47.6	ref			
HMO cost	55.0	1.34	1.17-1.55	1.17	1.00-1.36
HMO risk	44.3	.87	.79-.97	.82	.74-.91
Region***					
Santa Clara region	36.1	.57	.48-.68	.54	.44-.65
Central region	37.7	.61	.51-.73	.75	.61-.92
Sacramento region	47.0	.90	.78-1.04	1.00	.84-1.18
Tri-County region	48.3	.94	.77-1.15	1.13	.91-1.41
Inland Empire region	44.1	.80	.68-.93	1.05	.88-1.16
North region	46.2	.87	.73-1.03	1.13	.92-1.40
San Diego region	49.0	.97	.84-1.12	1.05	.90-1.22
Bay Area region	58.0	1.40	1.22-1.59	1.33	1.16-1.53
Los Angeles region	49.8			ref	
Orange County region	43.6	.78	.67-.92	.71	.60-.83
Stage at Diagnosis***					
In situ	63.5	ref		ref	
Localized	44.9	.47	.42-.53	.48	.42-.54
Race/Ethnicity***					
African American	49.2	1.05	.85-1.30	.96	.77-1.20
Asian	39.4	.71	.57-.88	.64	.51-.80
Latina	46.0	.93	.79-1.09	.95	.80-1.13
White	47.9	ref		ref	
Other/Unknown	62.5	1.82	1.13-2.93	2.1	1.25-3.37
Age***					
65-69	49.1	ref		ref	
70-74	46.3	.89	.81-.99	.89	.80-.99
75-79	46.0	.88	.79-.98	.91	.81-1.03
80-84	46.5	.90	.79-1.03	.95	.83-1.09
>84	52.6	1.15	.98-1.34	1.26	1.07-1.49
Marital Status					
Never married	42.3	.77	.66-.91	.76	.64-.90
Married	48.7	ref			
Divorced	51.1	.91	.84-1.00	.90	.82-.99
Widowed	46.4	1.10	.94-1.3	1.11	.95-1.31
Unknown	50.5	1.08	.80-1.44	1.04	.76-1.41
Median income (per $5000)	——	1.05	1.03-1.06	1.04	1.03-1.07
Percent rural zip code area***					
None	50.3	1.31	1.21-1.42	1.34	1.21-1.50
Some	43.6	ref		ref	

Adjusted for other variables in Table.

TABLE 3: Adjusted odds ratio (95% Confidence Interval) of BCS for Medicare risk HMO vs Medicare FFS by region in California..

Region#	AOR	95% CI
Inland Empire Region	.66	.50-.88
San Diego Region	.89	.67-1.15
Bay Area Region	1.25	.84-1.88
Los Angeles Region	.63	.54-.75
Orange County Region	1.41	1.05-1.91

Santa Clara region, Central region, Tri County region, Sacramento region and North region all had fewer than 50 women enrolled in Medicare risk HMOs.

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June 3, 1996

Jeffrey Newman, M.D., M.P.H.
Principal Clinical Coordinator
California Medical Review, Inc.
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San Francisco, CA 94105

Dear Dr. Newman,

Thank you for meeting with me and my staff on April 26th to discuss mutual progress on linking HCFA files with the California Cancer Registry. The linkage with 1993 female breast cancer Medicare patients has been extremely informative for assessing case ascertainment. As we discussed at that meeting, we would like to request the following additional data:

1. Cohort: women treated for breast cancer in 1993 (all members of previous cohort)
   Years: 1992, 1993, 1994
   Fields: HIC number (for linkage with original data file), admission (Part A and B) and discharge dates (Part A only), all treatment and diagnosis codes
   Source: Medicare Part A and B

2. Cohort: persons treated for prostate cancer (ICD9 code 185-), melanoma of the skin (ICD9 1720-1729), and chronic lymphocytic leukemia (ICD9 2041)
   Years: 1994
   Fields: first, middle and last name, date of birth, HIC number, social security number, sex, address, zip code, admission (Part A and B) and discharge dates (Part A only), name of facility where treated, address of facility where treated, diagnosis and treatment codes
   Source: Medicare Part A and B

These data will be used to obtain co-morbidity information on breast cancer patients, to evaluate our reporting of treatment, especially radiation and chemotherapy, and to assess 1994 case ascertainment of the three additional cancers.

If you have any questions or need additional information concerning this request, please contact myself or Mark Allen. Thank you for collaborating with us on this project.

Sincerely,

William E. Wright

William E. Wright, Ph.D., Chief

cc: Mark Allen, M.S., Research Scientist, CCS
Martin J. Kileen, M.D., M.P.H., HCFA Region X